E LIBRARY

OCT 1 2 1925

Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

McGRAW-HILL COMPANY, INC.

October 10, 1925

Placer mining has materially changed the landscape of Bonanza Creek, in the Yukon. The long winding ridges of tailings that remain after treating the auriferous gravels bear witness to the huge tonnage of material that has been handled.

THE TRAIL OF THE GOLD DREDGE

Analyzing Concentrates Graphically, by Herbert Rose

Cooling Mine Air—Possibilities and Limits, by Thomas T. Read

Mining Camps of North America: *Ouray—Famous for the Camp Bird,* by Clifford R. Wilfley

Cover photo by Burton Holmes from Ewing Galloway

TO ENDURE—the Belt Conveyor Carrier necessarily embodies correct mechanical principles, live shaft design, ball bearing equipment and sturdy supporting brackets. With nicely balanced pulleys and smooth-running ball bearings the Carrier keeps the power of the conveyor to a very low demand.

Ingenious design, fine materials and good workmanship have produced this Carrier of remarkable qualifications.

The Sacon, a Carrier with an enviable record of achievement

STEPHENS-ADAMSON MFG. CO.
Main Office and Plant—Aurora, Illinois
Pacific Factory Branch—Los Angeles, California

STEPHENS-ADAMSON
S-A BELT CONVEYORS

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 120 New York, October 10, 1925 *Number* 15

Taking the Guess Out of Metallurgy

ONE WHO MOVES ABOUT among the mills and smelters of the country cannot but be impressed with the increased use of precision instruments in metallurgical work of all kinds. The operator who can tell by the eye, trained by experience, whether a process is going right or not is not relied upon so much as he was a few years ago. On entering a superintendent's office, nowadays, one is pretty apt to see the top of the desk, and the walls too, adorned with perhaps a dozen files of circular charts affording an indisputable record of blast and compressed-air pressures, drafts, power consumptions, speeds of machines, and, most common of all, temperatures. One even occasionally sees such unusual records as those given by recording psychrometers; and many smelters have a full equipment of the instruments necessary in any good weather-bureau station. In addition to these, many portable instruments are used throughout the plant as aids to the operators, recording instruments not being necessary.

The installation of instruments of this nature has been brought about for several reasons. In the first place, the operator can tell, definitely, just what some of the conditions are that are necessary for good results, and if they are not right he can take prompt steps to make them so. Secondly, the superintendent has a log of what the operating men are doing; he can tell whether the off-going shift worked properly up to the time they went off duty; whether the doors of a furnace, perhaps, were left open too long. He thus has an invaluable aid for the fixing of responsibility for poor results. In the third place, the superintendent is given a definite record of certain important conditions which are necessary to him in making a proper comparison of metallurgical results. He can compare what was done when the temperature and draft of a certain furnace were so and so, with the results when these factors were different. Fourthly, many of the newer processes require very exact control—sometimes pyrometer leads are installed on every hearth of a roasting furnace, for example, as well as in the air space above each hearth.

The thermocouple—even the precious-metal thermocouple—is no longer a laboratory instrument alone. It has been made of rugged construction, and 10 or 15 ft. long if necessary, with various refractory coverings that adapt it to the most severe operating conditions. In these days of electrical appliances in most every home and of the radio, almost any one knows enough about wiring to take care of the electrical end of an indicating or recording instrument, so the services of an expert electrician are rarely required. Though vastly improved over the types available a few years ago, increased production and competition have kept prices down, and precision instruments can be obtained for a modest outlay, considering their life and usefulness.

Sometimes the older generation of operators do not take kindly to new-fangled ideas designed to make their work more efficient and tending to eliminate some of the value of their experience. We do not find any of this spirit, however, among the users of the instruments we are discussing. A few weeks ago we stood in a lead refinery talking to the foreman, who was evidently one of the old school. The last dross had just been removed from a 100-ton kettle of molten lead, and we asked if he were going to cast it right away. "Just a minute and we'll see," he said. "You watch that meter when I plug her in." Into the kettle went the long pyrometer rod and gradually up towards 700 went the indicating needle. "Around 660 is about right," he explained, "but in the cold weather we can have it sometimes up to 700." After a minute or two—"Yes, she's just right. Start the pump."

The Problem of Growth

IT IS NATURAL that the country which has had the greatest mineral resources—the United States—should have developed mineral technology and management, and the improvement of mining machinery, to the highest degree. It is likewise natural that the British Empire, which has been a close second in mineral resources and their development, should rank high in the development of the art. Germany and France, with their great mining interests and highly developed culture, have been well represented also. Germany and England—Freiburg and Cornwall—gave America her first lessons.

With the expansion of the world's industries at a rate greater than that of the output of American mines, the high concentration of mining capital and technology that has been built up in the United States has naturally overflowed abroad, flooding over North America and South America and sending out streams to Asia and Africa.

The process of becoming international was part of the British heritage; but has been only slowly forced on the United States through circumstances. New problems of export and import trade in metals and minerals, of trading in metals by American mining companies between countries outside of the United States, as between South America and Mexico and Europe, then arise; and have to be mastered, new as they are, if progress is to continue. More and more those who are studying and developing this trade become impatient of tariffs, export and import, which interfere with its development along economic lines defined by nature. Necessary though tariffs may be, there is little question that national and world prosperity will result best in the long run from a minimum of artificial trade obstructions between countries.

If the development of export business in mining machinery is to keep pace with the development of foreign mining by American capital, this problem of artificial barriers to trade must be carefully studied, together with the other problems, economic and psychologic, which affect the development of foreign

trade. American mining machinery is used practically exclusively in the United States, but when we come to Mexico, for example, we find considerable importation from Europe. American mining machinery is in great favor in Africa, in the copper regions of the Belgian Congo, and elsewhere; but while American-built drills, for example, are supreme in the United States, English drills predominate in the South African gold fields.

The reason for the division of the world's markets warrants a careful analysis. It is of great importance to the mines of the world to find out where they can buy best and cheapest.

What Is a Magma?

VARIOUS DISTINGUISHED GEOLOGISTS having attempted to define magma, with varying but on the average poor success, Prof. Waldemar Lindgren essays it in a paper read before the National Academy of Sciences.[1] He says:

> "The word magma has a perfectly definite meaning. It describes a liquid of high temperature consisting of a solution of complex silicates in each other, perhaps with admixed oxides and always containing a certain quantity of dissolved volatile matter. . . . I submit that logical usage demands that the term 'magma' be restricted to the above definition. . . . When differentiation has proceeded to the point where only one component or several similar components remain, the term magma should be dropped. One may properly speak of quartz, or iron ores, or gases *of magmatic origin*."

Considering this, the editor would first move to strike out the word *perfectly* as redundant and too jocund for the dignity of the National Academy of Sciences. It arouses the suspicion that Professor Lindgren may be spoofing, so that we examine the definition with greater care. Essentially, Professor Lindgren says a magma is a liquid. But at the high temperature which he mentions, it is universally acknowledged that the water or its components are gaseous, and that the other gaseous components are varied and important. Therefore *fluid* would be a more accurate term than *liquid,* since liquid is opposed to gaseous. Passing over the wonder why in the perfectly definite definition the "admixed" oxides are prefaced by a "perhaps," one pauses at the dictum that the volatile matter is "dissolved" in the silicates. Why not, the freshman inquires, vice versa: to wit, the silicates dissolved in the gases? Or why not the silicates and the gases in part coexisting and separate? Indeed, the ancient and modern conception of granite magmas at least—a conception the general truth of which is well founded—is that the granite magma remains fluid at comparatively low temperatures by virtue of the volatile constituents.

Finally, omitting various other reflections for the sake of brevity, Professor Lindgren would surely not, on second thought, insist on the last-but-one sentence quoted. He would grant, for example, that the fluid from which a pyroxenite has crystallized is a magma, although pyroxenite by definition consists of pyroxene; or dunite, which by definition consists of olivine; or anorthosite, which by definition consists of the feldspar labradorite; or albitite, which by definition consists of the feldspar albite; or many other rocks. Indeed, it is a matter of common nomenclature that a magma may yield one mineral almost exclusively, or be "monomineralic." Daly observes, for example, ("Igneous Rocks," 1914, p. 447): "The gravitative differentiation of anorthosite . . . implies the segregation, in depth, of the monomineralic dunite magma, the bimineralic wehrlite or harzburgitic magmas, or the trimineralic lherzolitic magma."[2] Professor Lindgren, now being supposed to retract his statement so far as it applies to monomineralic magmas crystallizing as olivine, or pyroxene, or feldspar: should he be obstinate concerning a monomineralic magma crystallizing as quartz, claiming that it is no "magma"? Quartz is as truly and as undisputed a magmatic mineral as the others in question. Pegmatites are referred to by Daly as crystallizing "from gas-charged magma"[3] and Harker refers to pegmatites as representing "the final residual magma of plutonic intrusions," and Lindgren himself says "the pegmatites are essentially residual magmas," a slight carelessness of diction which we may overlook. Also he speaks of "the transitions of pegmatite dikes to deep-seated ore-bearing veins."[4] That a phase of pegmatite consists of pure quartz is universally acknowledged.

Professor Lindgren also objects to the conception and term of a magma which crystallized as iron ores. Probably all authority and logic is opposed to him here. To quote from the handiest book for the moment, Daly refers[5] to titaniferous iron ores as "obviously local differentiates of gabbroid magma," and observes that "the sulphide ores of Sudbury are magmatic differentiates." And Professor Lindgren himself, in a paper by Lindgren and Davey on the ores of Key West, Nev., describing nickel ores containing magnetite, pyrite, and chalcopyrite, writes of the metallic minerals, "We believe that they formed part of the magma of the dike and consolidated as the last of the minerals of igneous origin."[6]

Indeed it would appear that Professor Lindgren's definition of a magma, instead of being "perfectly definite," is singularly inaccurate. The sharp line which he desires to draw between rocks containing metals in paying quantities (and therefore called "ores") and those that may contain similar metals, but not in paying quantities (and therefore called simply "rocks") is properly a commercial distinction and not a scientific one. The term "ore magma" introduced by Spurr is, as above shown, accurate; and, indeed, is so obvious that it can barely claim novelty.

"Excitements"

ONE OF THE MOST PICTURESQUE features in the pioneering development of mining regions is the boom, or as it was picturesquely called in the language of the West, the "excitement." Since the boom or "gold rush" of the days of '49 to California, and the exodus to Australia and later to South Africa, the Klondike rush stands out picturesquely in memory. Only those who have witnessed such a movement can have an idea of its picturesqueness, its grotesqueness; the impoverished human psychology laid bare. The pho-

[1] *Proc.* Nat. Acad. Sci., Vol. 11, No. 1, January, 1925.

[2] Mineral Deposits, 1919, p. 762.

[3] *Op. cit.*, p. 368.

[4] *Op. cit.*, p. 761.

[5] *Op. cit.*, pp. 454, 455.

[6] *Econ. Geol.*, Vol. XIX, No. 4, June-July, 1924, p. 309.

tograph has preserved the curious scene of a long, solid line of pack-laden human beings climbing the steep snowy sides of the Chilkoot pass, to work down a thousand miles further to the Klondike gold fields. More fleeting, and less spectacular, but full of color and interest, were the minor "excitements" later in Nevada, Ontario, British Columbia, and elsewhere. In Nevada the competition became so modern that excitement-chasers made the trip by automobile, instead of by old-fashioned and slower methods. The hurried staking, wild and exaggerated rumors, changing of claim ownerships, organization of companies, sales of option and stock thrive most luxuriously under these convenient conditions; but blossom everywhere.

Only a year or two ago the Elbow Lake region, in Manitoba, was raided by an "excitement" in the middle of winter; hundreds of claims were staked blindly in the snow, and changed hands or were consolidated in all seriousness. Actually, the chance under such conditions was like the finding of a needle in a haystack as to the finding of profitable ore; but for the realization of something by selling claims to excited buyers, possibility was of course far greater. The fade-away of such an excitement is far less tangible than the attack: it dissolves gradually, amid optimistic protestation and auguries of those who are bound elsewhere. Mainly, however, there is in a short space of time nothing left but the wilderness. But once in so often the find is permanent: production grows, although it may be restricted to a tithe or less of the claims staked; and a rich and permanent contribution to the world's mineral wealth is born. Such a contribution was California, Australia, the Klondike; and likewise the rich camps of Nevada and of Ontario.

One of the most striking of recent "excitements" has been that following the platinum discoveries in South Africa. What will come of this is not quite certain. It appears sure that many organizers of companies and buyers of stock will be disappointed; while out of it all, when satisfactory processes are devised, may spring an important source of platinum—possibly the world's greatest reservoir: but in the hands of a relatively few.

Booms are not confined to mining finds. History records many examples of the boom psychology, the most remarkable of which was the tulip craze which once bankrupted Holland. Real estate and land values, however, are doubtless the most usual subject of speculation, and the field for the manifestation of the boom psychology. And the most recent and astonishing of these is now going on in Florida. Southern California was populated by a similar wave of migration and investment, but the momentum never approached that of the Florida boom. A flat, sandy, and uninteresting country, timbered with scrawny pines, it was unhonored and unsung from the time that Ponce de Leon sought the fountain of youth there. St. Augustine, the oldest city in the United States, remained one of the smallest cities. The one recommendation for Florida was that it was warm and balmy in winter, with good bathing. The building of a railroad along the east coast to Key West, and the establishing of a winter resort at Palm Beach, was the first indication of the growing need of the northerners for an American cold-weather resort. Still the movement grew slowly, until a year or so ago it developed into an astonishing "excitement," with sky-rocketing of land values and the wildest of speculation. Sober judges agree that land prices have been advanced to figures far in excess of their economic valuation, and in many cases to foolish figures. Whoever invests at the present time should, according to all rules, lose rather than gain. A soap bubble cannot be inflated indefinitely. So wide-spread is the interest that it is worth while to quote from a recent sober opinion published:

"Florida has an enormous coast line extending nearly 1,600 miles and literally millions of acres of land attractive as home sites. Almost any portion of this coast line and home site acreage is capable of development for resort purposes. By no stretch of the imagination can it be believed that all the resort developments now under way (both on the coast and inland) will wholly materialize or that the high prices now quoted for residential properties throughout the state can be wholly maintained."

Yet when the storm is over, beyond question the state will have experienced a great and permanent increase of population, industry, and prosperity.

The "excitement," whether in mines or land, has its place. Most people depend on emotion, rather than logic, for their stimuli to action. The engineer of mines is always lamenting that while the investor is not interested in a mining proposition nakedly presented, he will dig up his money for the golden picture brilliantly drawn, the like of which never was on sea or land. It is the spirit of adventure, of romance, which tempts him out of his prudence, and which produces the wild scenes of excitement out of which, when the wreckage has been cleared away, the dead buried, and the wounded shipped away, a permanent and desirable advance in industrial prosperity is recorded.

Gold Rushes on Broadway

BROADWAY in the Roaring Forties has always had its "gold diggers"; but a recent week was dedicated to gold rushes. Two elaborate moving picture productions made their world premières in theaters almost across the street from each other. "Winds of Chance," adapted from the novel by Rex Beach, and "The Gold Rush," written, directed and acted by Charlie Chaplin, both deal with Alaska, the Yukon and the mad rush for gold. As a comedian, Chaplin, with his matchless feet, his wry mustache, and his intriguing smile, ranks at the top; perhaps there is something tragic in the bedraggled little figure, a misfit in a cold world. But as a scenario writer and producer Charlie is out of his element, at least when it comes to portraying life in the gold regions of Alaska.

"Winds of Chance," on the other hand, gives the impression of reality that comes from being directed by someone who knows the country. Real places, Dyea, Chilkoot Pass, Whitehorse rapids, Dawson, Hunker Creek; convincing reproductions of events that might really have taken place; men and women who dress and behave as those who actually were there in 1896 and 1897 might have behaved. Shooting real rapids in real boats supplies more thrills than the antics of a cabin blown around on wheels by a fake wind. Even the combination saloon, gambling house, and dance hall, without which no movie of frontier life is complete, looked natural in "Winds of Chance," which is more than can be said for the same institution in Charlie's "Gold Rush."

Stanford University and the Six-Year Engineering Course

An Interview with Theodore J. Hoover

THEODORE J. HOOVER

WITH the termination of the present academic year Stanford University has definitely committed itself to a six-year course and has established an engineering college comprising all of the engineering units, mining and metallurgy, civil, electrical, mechanical, and chemical engineering. Theodore J. Hoover has been chosen to head the new unit in the capacity of dean. In outlining the plan of reorganization Mr. Hoover said: "The basic ideas of the plan which has been adopted by the Board of Trustees of Stanford University have been under discussion for a number of years. They have been tried out in the Department of Mining and Metallurgy, which established a six-year course in 1919. The results have been such as to convince us that the six-year plan is worthy of extension to the other engineering departments.

"The important features of the new plan are first, the formation of a lower division which will include two years of general work for all engineering students. Second, an additional two years completing a four-year undergraduate course leading to an A. B. degree in engineering. The work of the last two years will be broad in its scope — mathematics, economics, history, business law, and courses in the business college, language, geology, physics, general science, and cultural courses. A small number of options, aggregating from 10 to 40 units, will be permitted students who have elected specific engineering courses. These options will be restricted to basic or general departmental courses in the several groups. Third, a two-year graduate course in the special branch of engineering elected by the student. The bars will be down and the student will be given professional work to the *n*th degree, in fact, all that he can master. The professional engineering courses will be remodeled and amplified to accord with this condition.

"I am especially anxious to work out this idea of engineering superimposed upon a broad fundamental undergraduate course based upon the sciences and cultural subjects. We cannot teach engineering in the university, but we can train men in the use of precision apparatus, in theory and in principles. We can train them in an orderly method of thinking, in marshaling facts, and in an appreciation of dimensions and quantities.

"Looking backward over thirty years of technical education, it is of special interest to note the general adoption in laboratories of commercial machines. This marks a passing phase, and I am convinced that commercial sizes of machines are unimportant for the equipment of laboratories. Men, books, and scientific and precision apparatus are the important educational tools. The facile use of the English language is of the greatest importance. Training in economics is an outstanding point, for engineers, in my opinion, must have a substantial background of economic facts. Engineering practice must be individually developed by experience in the field.

"The details of our general plan have not yet been determined, and a special committee will have this in hand. I have unbounded faith in this idea in spite of failures elsewhere to make the six-year plan workable. The narrow, highly specialized technical course, based upon four years, has been tried out and found inadequate. It has produced the technician who goes about with a monkey wrench in his hip pocket. The opposite type, a thoroughly trained executive with a well-balanced outlook upon life, who is capable of participation in general public affairs and who will be a leader in his profession as well as a capable technician, is the objective which Stanford University has set out to attain. The development of the Junior College plan in the educational system of California promises to reach a point such that within a few years it will be possible to abandon the lower division instruction in the engineering course and restrict the University work to the upper division of undergraduate work and the post-graduate engineering courses. This will make it possible to more effectively expend our budget, which now totals about $100,000 per year for all engineering departments."

Mr. Hoover is a Stanford alumnus. He acquired his engineering experience in the mining industry. Soon after graduation, in 1901, he became assistant manager of the Standard Consolidated Company at Bodie, Calif., and manager in 1903. While at Bodie he introduced tube-mill grinding and vacuum filtration and constructed a complete ore-treatment plant. He also reconstructed the hydro-electric plant, which was one of the first California plants to be installed for mine service. From 1906 to 1910 he served as consulting engineer for Minerals Separation, Ltd., of London, in the course of his work inventing new processes and machinery for the application of the flotation process. He designed and supervised the erection of ore treatment plants in Mexico, Australia, Finland and Russia. From 1911 to 1918, he served as director and president of over twenty mining, metallurgical, and petroleum companies in different countries. His experience has touched many phases of mining. Since 1919 he has been head of the mining and metallurgical department of Stanford University.

Analyzing Concentrates Graphically

How to Construct and Use Nomographic Charts for Determining Constituents

By Herbert Rose
Metallurgical Engineer, Nacozari, Mexico

IN ORE-DRESSING PLANTS, particularly those practicing "selective" flotation, it is frequently desirable to express the makeup of the concentrate produced in terms of the mineral constituents as well as in terms of the significant elements. As an illustration, in the flotation of chalcopyrite mixed with pyrite, the "selectivity" of the process is determined, not directly by the relative amounts of iron and copper present in the concentrate (since chalcopyrite contains iron), but by the relative amounts of pyrite and chalcopyrite present. In other words, determination in this case of the completeness of rejection of pyrite requires calculation of the amount of iron in the concentrate which is combined as pyrite. Although this is not an involved calculation, a graphic solution is much more convenient and is decidedly advantageous if the problem is one of frequent occurrence. Indeed, a graphic chart may be devised for almost any type of concentrate, whereby the complete mineral constitution for any given set of assays may be read off directly without calculation. The present article describes the method of constructing such a chart for any class of concentrate, and three typical cases are illustrated, $CuFeS_2$–FeS_2, Cu_2S–FeS_2, and PbS–ZnS–FeS_2.

Fig. 1 illustrates the concentrate produced by a certain all-flotation plant in the Southwest. In this case,

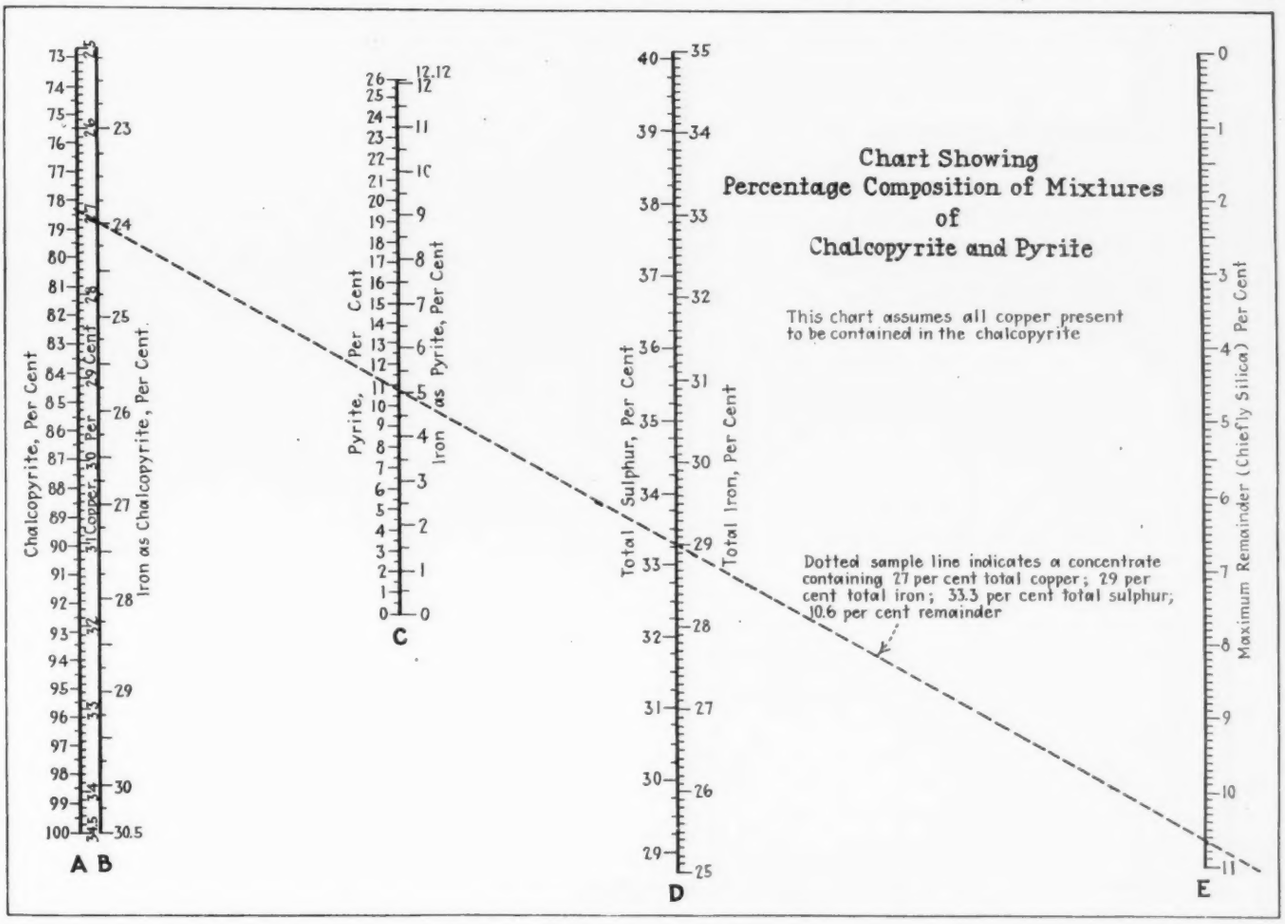


Chart Showing
Percentage Composition of Mixtures
of
Chalcopyrite and Pyrite
This chart assumes all copper present to be contained in the chalcopyrite
Dotted sample line indicates a concentrate containing 27 per cent total copper; 29 per cent total iron; 33.3 per cent total sulphur; 10.6 per cent remainder
Chalcopyrite, Per Cent
Iron as Chalcopyrite, Per Cent
Pyrite, Per Cent
Iron as Pyrite, Per Cent
Total Sulphur, Per Cent
Total Iron, Per Cent
Maximum Remainder (Chiefly Silica) Per Cent
A B
C
D
E

Fig. 1

the concentrate is predominantly chalcopyrite, with some pyrite and not over 8 to 10 per cent of siliceous material. As the mill rejects about 90 per cent of the pyrite of the original feed, the amount of pyrite in the concentrate is watched closely. Fortunately, the amount of copper combined in forms other than chalcopyrite is small enough to be negligible, and the iron not combined as pyrite is also negligible in the concentrate, as practically all of the iron in oxide and silicate form is rejected with the siliceous gangue.

As is customary in such cases, the concentrate is assayed only for total copper, total iron, and "insoluble." With only the per cent of copper and iron known, the following additional information may be read from the chart shown in Fig. 1: Per cent of chalcopyrite, per cent of pyrite, per cent of iron combined as chalco-

pyrite, per cent of iron combined as pyrite, per cent of total sulphur, and the maximum possible percentage of material other than pyrite and chalcopyrite. Although not indicated in Fig. 1, the same chart could, without difficulty, be made to show also the percentage

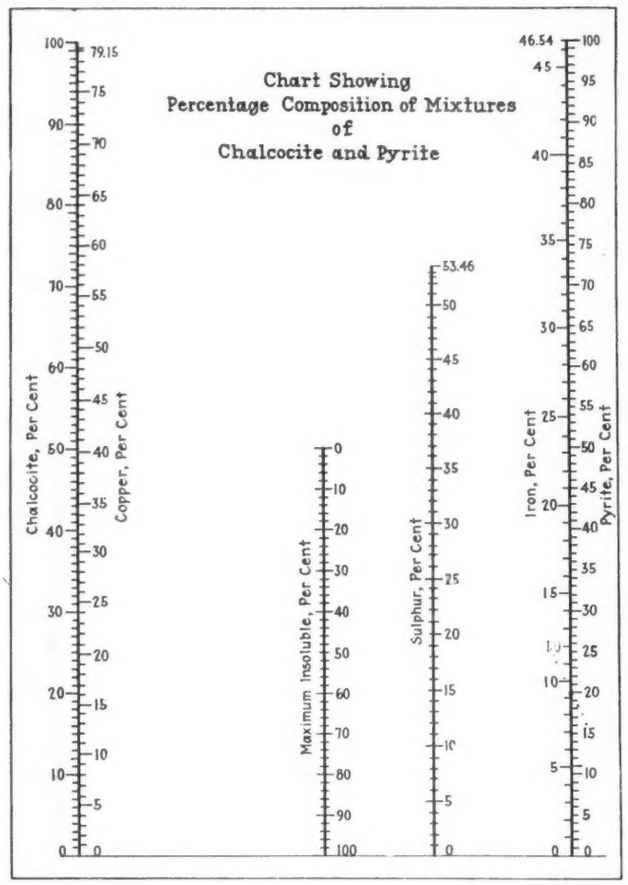


Fig. 2

of sulphur combined with each of the individual sulphide minerals.

For such diagrams, the nomographic or alignment chart is preferable for a number of reasons to the usual type of co-ordinate chart employing mutually perpendicular scales. The alignment chart uses very few lines and is therefore more easily read; interpolation is made along a scale rather than between curves, thus increasing accuracy; it is simpler to construct, and it indicates instantly the change in any one variable due to changes in other variables.

The construction of nomographic or alignment charts depends on the representation of an equation in three or more variables by means of scales along curves or straight lines, in such a manner that a straight-edge laid across them cuts the scales in simultaneous values which satisfy the equation.

How to Construct a Chart

The chart of Fig. 1 is constructed as follows: The *A* scale is drawn, and graduated in terms of per cent of copper through the range likely to be encountered in the mill. As in this case all of the copper is combined as chalcopyrite, the per cent of chalcopyrite may be superimposed directly on the copper scale. The chalcopyrite scale is therefore graduated on the same line to accord with the fact that chalcopyrite contains 34.5 per cent of copper. Similarly, the per cent of iron (*B* scale) combined as chalcopyrite is fixed by the per cent of copper. As it cannot be superimposed for lack of a place, it is drawn immediately adjacent and is read as though coincident with the *A* scale. The iron-as-chalcopyrite scale is graduated to conform with the fact that chalcopyrite contains 30.5 per cent of iron.

Except for possible confusion of graduations, the *B* scale could be calibrated along the left side of the line to show the per cent of sulphur combined as chalcopyrite, since that is also fixed by the copper assay.

The *D* scale is then erected, showing the per cent of total iron. Its position is governed entirely by convenience and the size of paper used. This line is then graduated on one side to cover the range of total iron likely to be encountered in practice. The *A* and the *D* scales automatically fix the position and length of all of the remaining scales on the chart.

The pyrite scale (*C*) is then determined. Although it is possible by means of transversals to calculate its position and size in advance, using similar triangles, a simpler method in such cases is by the intersection of several combinations giving the same value on the scale being sought. The latter method is more convenient for the present case and works out as follows:

Zero per cent pyrite would lie on a line joining 100 per cent chalcopyrite on the *A* scale with 30.5 per cent total iron on the *D* scale. Also, zero per cent pyrite would lie on a line joining, for instance, 25 per cent iron on the *B* scale with 25 per cent iron on the *D* scale. The intersection of these two lines is therefore the one possible point for zero on the pyrite scale. Similarly, all lines joining iron values on the *B* scale to iron values on the *D* scale which are numerically five greater will intersect in a common point which represents 5 per cent iron as pyrite. After thus determining two points on the iron-as-pyrite scale, the remainder of the scale may be stepped off with the dividers, since in the present type of equation scale divisions are uniform and scales are parallel. With the iron as pyrite now determined, the total-pyrite scale may be established on the same line, because the pyrite is in fixed relation to the iron combined as pyrite.

The scale showing total sulphur may now be established. Ordinarily, this will appear as a separate scale, as in Figs. 2 and 3, but it happens in the present instance that it may be scaled off on the as yet unoccupied left half of the *D* line. The per cent total of sulphur is fixed as soon as the percentages of pyrite and chalcopyrite are determined. One point on the sulphur scale is therefore established by scaling across various combinations of pyrite and chalcopyrite, which will give one sulphur value and therefore will intersect at a point. Another point on the sulphur scale is determined in the same way, and the scale may then be completed by use of the dividers.

There remains one possible scale—that showing the residue after the pyrite and the chalcopyrite have been taken care of. In other words, the approximate percentage which the laboratory will return as the "insoluble." This scale is also determined by means of intersecting lines as follows: 100 per cent chalcopyrite and zero per cent pyrite would give zero per cent insoluble and 80 per cent chalcopyrite and 20 per cent pyrite would also give zero per cent insoluble. The lines joining these two combinations will intersect at a point which is zero on the insoluble scale *E*. Any other point

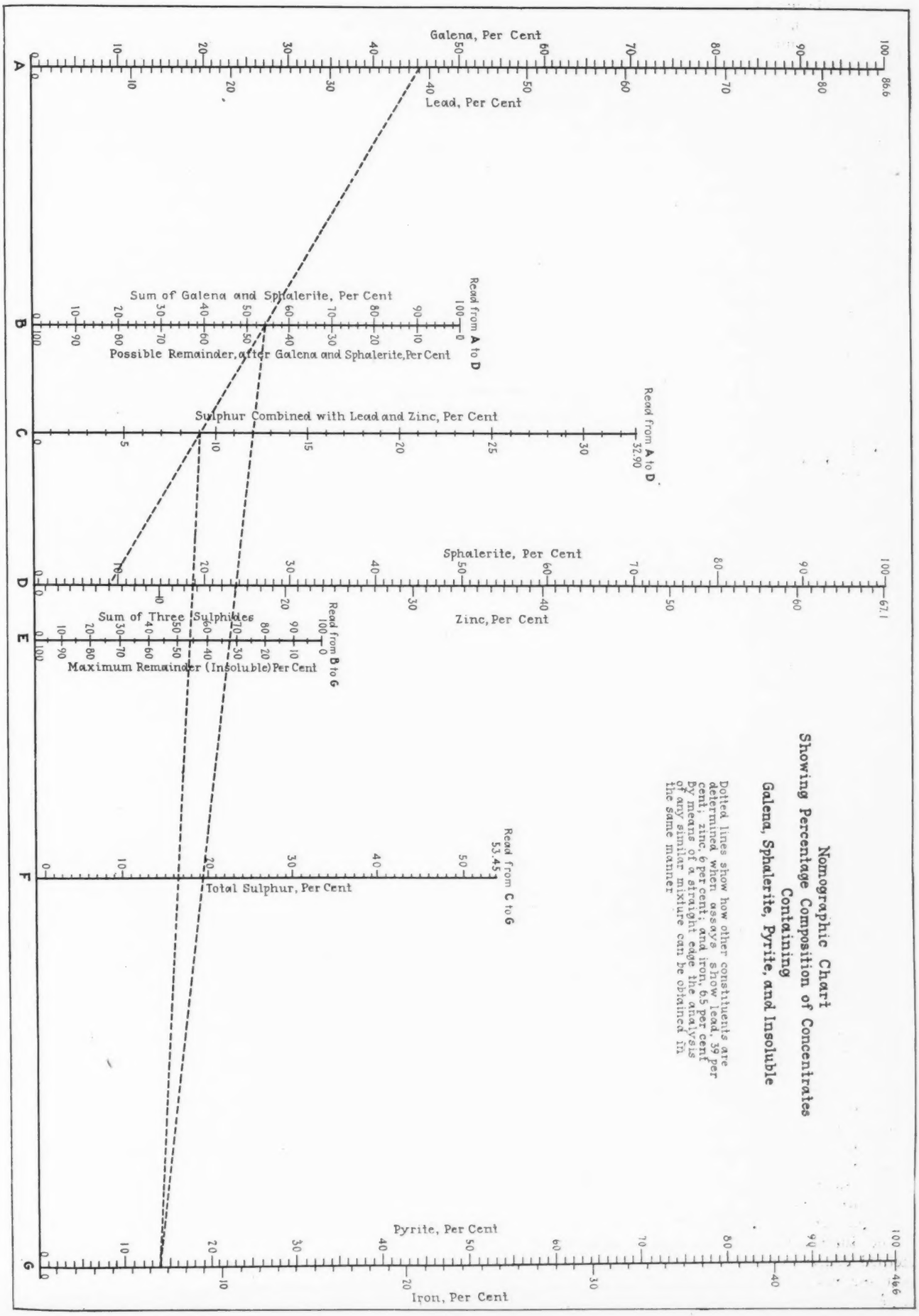

Galena, Per Cent
Lead, Per Cent
Sum of Galena and Sphalerite, Per Cent
Possible Remainder, after Galena and Sphalerite, Per Cent
Read from A to D
Sulphur Combined with Lead and Zinc, Per Cent
Read from A to D
Sphalerite, Per Cent
Zinc, Per Cent
Sum of Three Sulphides
Maximum Remainder (Insoluble) Per Cent
Read from B to G
Total Sulphur, Per Cent
Read from C to G
Pyrite, Per Cent
Iron, Per Cent
Nomographic Chart
Showing Percentage Composition of Concentrates
Containing
Galena, Sphalerite, Pyrite, and Insoluble
Dotted lines show how other constituents are determined when assays show lead, 39 per cent; zinc, 6 per cent; and iron, 65 per cent. By means of a straight edge the analysis of any similar mixture can be obtained in the same manner

Fig. 3

on this scale may be determined in a similar manner, and the scale is then stepped off with the dividers.

A typical sample reading of this chart is given as part of Fig. 1.

Chalcocite and Pyrite

Fig. 2 is a chart which shows all possible combinations of chalcocite and pyrite throughout the range from zero to 100 per cent of each. It is derived in a manner exactly similar to the method of Fig. 1, but is somewhat simpler because of the fact that it contains no three-element mineral such as chalcopyrite. It also could be made to show the per cent of sulphur combined in each individual mineral, if that information were desired. A larger scale with more accurate reading would be obtained by plotting only the range likely to be encountered in a given mill.

A Three-Mineral Chart

The idea carried out in Figs. 1 and 2 for two sulphide minerals could be extended to three, or even more, minerals. Though a greater number of compounds naturally adds to the complexity of the chart, such mineral combinations do actually exist in nature, and the chart merely portrays them.

The combination of three sulphide minerals may be handled in the nomographic chart scheme by considering them as two separate pairs with a common constituent. Fig. 3 shows the frequently occurring system, galena-sphalerite-pyrite, throughout the entire range from zero to 100 per cent of each. Fig. 3 may be derived as follows:

The Pb–PbS scale (*A*) and the Zn–ZnS scale (*D*) are erected in any convenient size and position. The sulphur scale (*C*) is then determined by means of intersecting lines, as already described in connection with Fig. 1. Obviously, the highest sulphur value possible is 32.9 per cent, since that is the percentage in 100 per cent ZnS, and ZnS contains more sulphur than PbS. The upper limit of the sulphur scale is therefore its intersection with the line joining zero on the *A* scale with 100 per cent on the *D* scale.

The *B* scale is then erected. The information it yields is of no great value, but it is very necessary as a modulus in reading the remainder of the chart. It represents the residue after the ZnS and PbS have been taken into account; in other words, it is the sum of the pyrite and the insoluble. As a matter of fact, the *A–B–C–D* scales constitute a complete chart in themselves for the system PbS–ZnS.

The pyrite scale is then drawn and graduated. Its position is determined by convenience, bearing in mind that the resulting scales should fall where they will not be confusing.

The *E* scale is then established by getting intersections at two specific points on various combinations of lines thrown across from the *B* to the *G* scales. For instance, zero on the *E* scale will lie at the intersection of two lines, one of which joins zero on *B* to zero on *G* and the other of which joins 100 per cent on *B* to 100 per cent on *G*. Since 100 per cent on the *E* scale lies on the base line, the *E* scale is immediately fixed. *E* represents the total residue after all three of the sulphide minerals have been taken into account; it is approximately the "insoluble" assay.

The total sulphur scale (*F*) is determined by a method exactly like that used for the *E* scale, except that the intersecting lines are thrown across from *C* to *G*.

The chart is now completed. It is read in exactly the same manner as Figs. 1 and 2, except that for complete information three positions of the straightedge are required. By way of further clarification, the following example of reading this chart is illustrated by the dotted lines in Fig. 3:

Assume that on a given sample the laboratory reports 39 per cent Pb, 6 per cent Zn, and 6.5 per cent Fe. The scale shows immediately that these values correspond to 45 per cent PbS, 9 per cent ZnS, and 14 per cent FeS_2. By laying a straight-edge across from the reported Pb to the Zn assay, we further find that 9 per cent sulphur is combined with the lead and zinc, and that PbS and ZnS make up 54 per cent of the total product, leaving 46 per cent to account for. We then lay the straight-edge from this value on the *B* scale to the reported assay of 6.5 per cent iron on the *G* scale, and on its intersection with the *E* scale it is seen that 68 per cent of the total product consists of the three sulphide minerals, leaving 32 per cent to account for as "insoluble" or other constituents.

Then laying the straight-edge across from the 9 per cent sulphur already found on the *C* scale to the assay of 6.5 per cent iron on the *G* scale, we find on the *F* scale that the total sample contains 16.5 per cent sulphur. It will be observed in practice that the sulphur reading is very close to the value which a laboratory sulphur determination would give, provided of course the assumptions regarding the kind of minerals in the ore are correct.

It must not be thought that these charts are in any way an attempt to "calculate the assays" (even though many a good millman has been tempted to do that very thing). Their sole purpose is to facilitate quick interpretation of the analyses reported by the laboratory. They are of particular value in studying screen analyses, for they may be used to determine on what meshes a particular mineral predominates.

California Produces a Little Platinum

In California platinum is obtained as a byproduct from placer operations for gold, according to the last quarterly report of the California State Mineralogist. The major part of it comes from the dredges working in Butte, Calaveras, Sacramento, Stanislaus, and Yuba counties, with smaller amounts from the hydraulic and surface-sluicing mines of Del Norte, Humboldt, Shasta, Siskiyou, and Trinity.

The production of platinum-group metals in California in 1924 totaled 337 oz., crude, containing 273 fine ounces, valued at $36,452. Of this amount, a total of 275 oz., crude, or 82 per cent, came from the gold dredges. This is less than 50 per cent of the 602 fine ounces, worth $78,546, sold in 1923, the decrease being due to cessation of dredging in Shasta and to a lessened output in Yuba County.

The above-noted total of 273 fine ounces includes 84 fine ounces of osmiridium and iridium, also some palladium. In addition some platinum is usually recovered as a byproduct in the gold refinery of the mint, but which can not be assigned to the territory of its origin for lack of knowing to which lots of gold it belongs. The San Francisco Mint has recovered as high as 100 oz. of platinum in a single year from this source, some of which unquestionably came from Californian mines. Some platinum and palladium are also recovered in the electrolytic refining of blister copper.

Cooling Mine Air—Possibilities and Limits*

By Thomas T. Read
Safety Service Director, U. S. Bureau of Mines

THE EXPRESSION "cooling mine air" may be interpreted in either of two ways, (a) as the actual cooling of the air to lower its temperature, or (b) the providing of air with sufficient cooling power to obtain results desired at the working face. The cooling power of a ventilating current is a function not only of its temperature but of its velocity and its moisture content as well. This function of the current may be increased by lowering the dry-bulb temperature, by increasing the velocity, or by decreasing the moisture content. Which of these should be done will depend on circumstances. Where the velocity of the air current is low, the best results with the least expenditure will usually be obtained through increasing the velocity of the current, through the provision of greater air circulation in the mine as a whole, or through rearranging the ventilation system so that a greater velocity is obtained at the working faces, or by providing auxiliary fans to increase the velocity at the places where it is most needed.

There is an upper limit, however, to the velocity of air current that can conveniently be used. Aside from the personal inconvenience of working in an air current of high velocity, the power required soon becomes excessive, because the frictional losses are proportional to the square of the velocity. Generally speaking, however, in almost all mines ventilating currents of sufficient cooling power can be obtained through modification of the velocity alone.

There are some mines, however, in which the underground temperature is so high that velocity, instead of being an aid, becomes a hindrance. If the air is above the normal temperature of the human body and is saturated with moisture at that temperature the air current has no cooling power, and an increase of velocity, instead of making the person more comfortable, makes him less comfortable, because the air current is bringing heat to the body instead of extracting it. Under circumstances such as these increase of velocity is of no help, and the desired cooling power must be obtained either through lowering the dry-bulb temperature, decreasing the moisture content, or both.

The best-known mine at which cooling of the ventilating current is done on a large scale is the Morro Velho of the Saint John del Rey Co., Ltd., in Brazil, and I have elsewhere[1] described in detail the method there used. The outside air, at a temperature of about 80 deg. F., with a moisture content of about 120 grains of water per pound of dry air, is cooled by refrigeration to a little above 40 deg. F., which at the same time reduces the moisture content to a little over 40 grains of water per pound of dry air. This cooled and dried air is circulated throughout the working places by fans, one being on the surface and one at the top of the upcast on the 4,126-ft. level. However, in passing down through the mine workings to the working faces, the air current takes up enough heat and moisture from the surfaces with which it comes in contact, so that by the time it reaches the working face it has a dry-bulb temperature of 98 deg. F., or essentially the same as it would have if it had not been cooled at the surface. The moisture content, however, is not so great, being only about two-thirds the moisture content of the ventilating current at the working face when it has not been cooled and refrigerated. The net result, however, was that the cooling power of the ventilating current, as determined by the wet kata-thermometer, was increased from 7.7 up to 20.5 millicalories per square centimeter per second. Of this improvement in the cooling power 80 per cent was due to the lowered temperature of the air and 20 per cent to increased velocity caused by the second fan.

It is interesting in this connection to note that the original condition, which gave a cooling power of 7.7 millicalories per square centimeter per second, was a temperature of 101.5 deg. F. dry-bulb, 87 deg. F. wet-bulb, and a computed air velocity of 220 ft. per minute, which corresponds to an effective temperature of 88 deg. F. The condition after refrigeration, and after the second fan was installed, was 97.4 deg. F., dry-bulb, and 76.2 deg. F., wet-bulb, and an air velocity of 540 ft. per minute, corresponding to an effective temperature of 78.7 deg. F. If, however, as pointed out by Yaglaglou,[2] the air in its original condition had been saturated, through the evaporation of water into it near the working face, both the dry-bulb and wet-bulb temperatures would have been reduced to 87 deg. F. and a velocity of 560 ft. per minute would have produced an effective temperature of 78.7 deg. F., thus giving the same cooling power as was produced through refrigeration and drying at the surface.

There are various reasons why the management may consider it inconvenient or undesirable to saturate the ventilating current of air just before it enters the working places, and, as pointed out above, the reducing of the dry-bulb temperature and the moisture content by refrigeration at the surface not only involves the construction of an expensive plant, but a large part of the cooling effect produced on the air by the plant is lost before the air reaches the working face, where its cooling effect is desired.

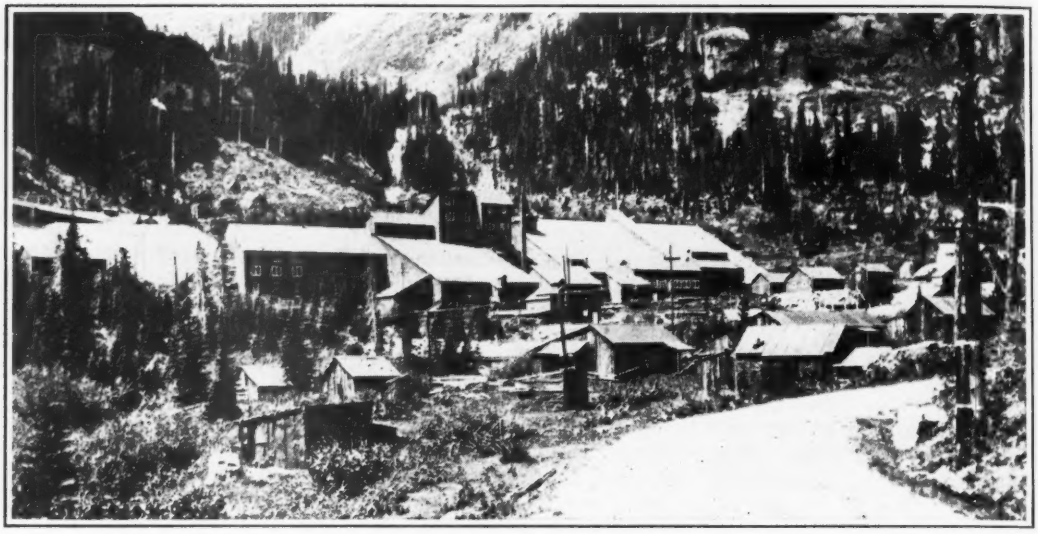
A suggestion of a possible solution of this problem, which is of much interest, arises in connection with some experiments recently made in England on the drying of the air blast for blast furnaces with the aid of silica gel. A small model of a plant designed for this purpose was exhibited in the chemical section of the Palace of Industry at the British Empire exhibition in London and is described in the *Iron and Coal Trades Review* of July 24, 1925. According to the announcement, a plant which is capable of drying 40,000 cu.ft. of free air per minute can be built for about $60,000. The operating cost will apparently be rather high, as it is estimated that approximately seven tons of coal per day will be required to reactivate the silica gel that has absorbed the moisture from 40,000 cu.ft. of free air per minute. In the case of a deep, hot mine that is dry, however, it may be possible to pass the return air current over the silica gel that has absorbed moisture and thus partly dehydrate it. at a considerable saving of fuel for the complete dehydration.

It may be said, therefore, that there is now no reason to believe that the temperatures encountered in deep, hot mines will prove a barrier to their being worked, since means are available to create sufficient cooling power under any conditions that have yet been encountered.

*Published by permission of the Director, U. S. Bureau of Mines.

[1]"Cooling of Mine Air," Report of Investigations No. 2554, U. S. Bureau of Mines.

[2]Journal of Personnel Research, Vol. III, p. 395, 1925.



The Camp Bird Mill

This well-known plant has not been operated since 1916, but has not been dismantled.

Mining Camps of North America

Ouray: Famous for the Camp Bird

In the San Juan Region of Colorado, Where Gold, Silver, Lead, Zinc, and Copper Have Been Produced

By Clifford R. Wilfley
Mining Engineer, Denver, Colorado

ENDOWED by Nature with a charm of setting seldom equaled, as well as the richest gold mine in the world and numerous other rich mines, Ouray has an enviable record. It is the natural outlet for the north part of the San Juan region of Colorado, a mining region notable on account of the variety and distribution of its valuable minerals. Gold, silver, copper, lead, zinc, fluorspar, and vanadium are mined, and as usually there are several of these in one ore, often with gold as a "stabilizer," metal market depressions do not entirely stop mining, and the region has been a steady producer for many years.

The San Juan proper is an isolated volcanic upheaval in the southwestern part of the state, comprising the counties of Ouray, San Miguel, San Juan, and Hinsdale; the respective county seats, Ouray, Telluride, Silverton, and Lake City, lie on the four sides of the volcanic center and are connected by narrow-gage lines of the Denver & Rio Grande Western Railroad with smelters at Leadville, Salt Lake City, and Durango. A splendid federal-aid highway has just been completed from Ouray through the center of the district to Durango, making a fine scenic highway as well as an aid to transportation.

Prospecting Began in 1874

The discovery and early development of the San Juan illustrate the remarkable hardihood of the first Colorado miners, for Denver was in the pioneer days the nearest railroad point, 380 miles away, across the continental divide. The first mining in Colorado was placer work in the early '50s, stimulated by the California discoveries. It was carried on at the site of what is now the city of Denver, and in the gulches of the Rockies west of Denver, where the famous mines of Gilpin and Clear Creek counties were developed soon after. The first miners in the San Juan came from here. Headed by John Baker, they reached Baker's Park, the site of Silverton, in 1860 or 1861, but retreated the same year because of the hostility of the Ute Indians and the rigors of winter in a high altitude, far from the base of supplies. A few adventurous men penetrated the district in following years, but little mining was accomplished and many men lost their lives. It was not until a treaty was concluded in 1874 with the Utes, headed by Chief Ouray, an Indian who is honored today as the white man's friend, that active work began; the miners from Clear Creek and Gilpin, and from Leadville, have left their record in the names of claims, for many San Juan claims bear the same title as well-known mines of those districts. Silver was the object of the search, for the other Colorado fields were yielding fortunes to the miners of that metal and lead ores carrying silver were easily smelted.

Many hardships were endured, for the ore had to be packed and hauled over very rough country about 125 miles to railroad points beyond the mountains, and supplies came in the same way. In 1881 Andrew Meldrum discovered the Yankee Girl mine, and the following year he and John Robinson discovered the Guston and Robinson, thus opening up the famous Red Mountain district. The smelter at Durango, south of the

San Juan, was started in this year and the Red Mountain district and its adjoining Ironton camp were the scene of lively activity for years. Otto Mears built the railroad from Silverton to Red Mountain and Ironton in 1888, giving connection with the smelter at Durango. Mr. Mears was one of the outstanding figures in the development of the San Juan by reason of his building railroads and wagon roads, as well as because of his active participation in mining. The road from Ouray to Red Mountain, long known as the "Mears Toll Road," was his work—a big task for the early days, for much of it was "shelf road" cut into the solid hard quartzite along the canyon walls; today a scenic highway follows the same route most of the way. The Red Mountain camp began to decline in 1893, when Congress repealed the purchasing clause of the Sherman act. T. E. Schwarz, O. P. Posey, and George B. Crawford, among others, were prominent in the exploitation of these mines at Red Mountain.

In 1893 the Bachelor mine was discovered by C. A. Armstrong, J. F. Sanders, and George R. Hurlburt, and in spite of the decline in silver prices beginning at that time, this mine produced a high-grade silver-lead ore for years, with steady dividends.

Thomas F. Walsh and the Camp Bird

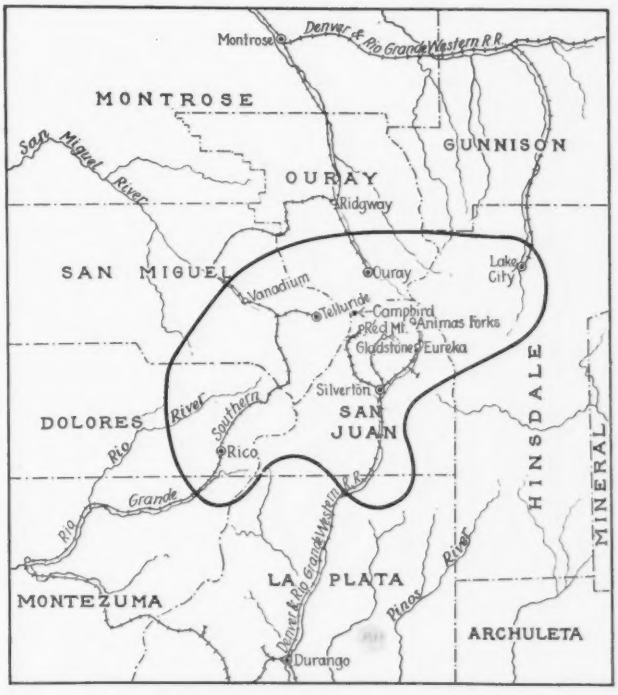
Little smelting plants were in operation at Silverton and Ouray at various times during the development of the San Juan. In 1896 Thomas F. Walsh was buying ore for one of these plants at Silverton; he was an active, keen, observant man who traveled the district extensively with his eyes open, and late that fall picked up some white quartz from the dump of a prospect high up in Imogene Basin, where silver was being sought and the quartz discarded. Walsh had the quartz assayed and was rewarded with an astonishing gold assay. He bought the property, the Una and Gertrude claims, for $10,000, and thus was founded the famous Camp Bird mine. Rich ore was shipped for a while, then a small concentrating mill was erected, followed by a large mill later, and under the management, first, of A. W. Richardson, and later of John W. Benson, about $6,000,000 was produced, with large dividends. In May, 1902, Walsh sold the mine to Camp Bird, Ltd., an English corporation, which owns it today. Under the management of William J. Cox, with Joseph Scott as mine superintendent and Thomas H. Woods as mill superintendent, this company operated the mine continuously thereafter until production ceased in 1916 and the work of driving a two-mile adit to cut the vein below was commenced. The following figures show the production during the ownership of the mine by Camp Bird, Ltd. All the ore was milled. The figures are for gross value, the average price received for each metal being given. About 820,831 tons of ore was produced, of an average gross value of $28.30 per ton, segregated as follows:

Gold	1,071,439 oz.	at	$20.426	$21,884,893
Silver	1,713,239 oz.	at	0.53739	920,673
Lead	16,507,983 lb.	at	0.029539	339,062
Copper	1,062,973 lb.	at	0.08432	89,628
				$23,234,256

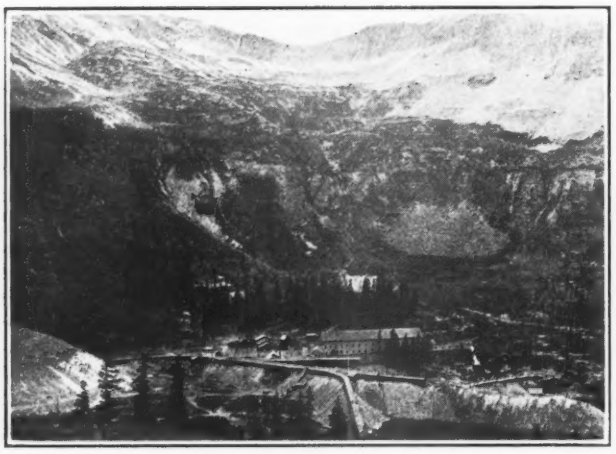
The total production, including that under Walsh, was around $29,000,000; of this, more than $18,000,000, or two-thirds, was dividends. A feature of this production was that, although this was a high-grade gold mine, with portions carrying very rich ore, the output was maintained at a nearly uniform grade throughout. One other operation that was an important feature of the history of Ouray was the exploitation of the Revenue group by A. E. Reynolds, with E. A. Krisher as superintendent, making a production around $16,000,000 of high-grade silver-lead ore and employing as many as 600 hand miners at one time. The backbone of this great mine was the Virginius vein, where a single ore-shoot was mined continuously to a depth of about 3,000 ft. over a maximum length of about the same distance. A concentrating mill, which burned down in more recent years, was operated for some time on the lower grade ores and was the only one that employed jigs to any important extent.

During more recent years the Camp Bird (till 1916) and Atlas (till 1924) were the largest operators. The Barstow was once a continuous producer, but its production has been small in recent years. The Mountain Top was once a steady producer of high-grade silver-lead ore; the Revenue had several periods of operation; the Bi-Metallist made a small production of very high-grade gold ore; the Red Mountain mines were operated for a time; the Calliope and Bachelor-Wedge, Pony Express, H. A. C., Jonathan, Sutton, Paymaster, San Antonio, and various others operated more or less extensively. The Norfolk smelter was operated by Thomas B. Crawford, who also built a mill at Ironton; the Gold Crown built a mill in Ouray under J. R. Roots; the Mineral Farm made a production during the war, and the Bachelor Consolidated began exploring the Bachelor lower levels through a new adit. The Wanakah Mining Co., under J. T. Roberts, Jr., operated extensively on Gold Hill, producing $1,000,000 in gold ore from a concentrating mill and operation of the Norfolk smelter. A 15:1 concentration was obtained from a heavy pyritic ore. Greenawalt sintering machines handled the flue dust.

The production of Ouray County to the end of 1923



Map of the San Juan region, including the Ouray District



Camp Bird mine
More than $21,000,000 in gold, in addition to silver, lead and copper, has been produced

is given by the U. S. Geological Survey as follows:

Gold	$35,200,000	Copper	3,300,000
Silver	32,200,000	Zinc	100,000
Lead	7,100,000		
		Total	$77,900,000

The following table gives a rough segregation of the output by individual mines and groups:

Camp Bird	Gold	$29,000,000
Red Mountain group	Copper-silver	18,000,000
Revenue	Silver-lead	16,000,000
Bachelor district	Silver-lead	4,000,000
Gold Hill	Gold	4,000,000
Others		7,000,000
Total		$78,000,000

For some of the data concerning the history and mine production, acknowledgments are due Thomas H. Woods, George B. Croft, and George R. Hurlburt, and Fred Carroll, and for photographs to Frank A. Rice.

Though this article deals particularly with the Ouray district, it can be taken as illustrative of the San Juan in its major features. The topography is exceedingly rough. The relief is about 6,000 ft., Ouray being at an altitude of 7,800 ft., while many summits are well over 13,000 ft. and several over 14,000. The country is forested with spruce, pine, and aspen, and is well watered by numerous streams, some of which are utilized for the generation of electric power in quantity.

Much Written About Geology

The geology exhibits such complexity and range that it can only be outlined here. It is well described in numerous publications, among which are those of the U. S. Geological Survey, the A.I.M.E., Colorado Scientific Society, Rickard's entertaining book "Across the San Juan Mountains," and the mining journals. One of the latest published studies is "Silver Enrichment in the San Juan Mountains," a bulletin of the U. S. Geological Survey, by E. S. Bastin. J. E. Spurr, in his "Ore Magmas" (1923), describes the Camp Bird, and the Pony Express and Bachelor veins; and in an article on "The Camp Bird Compound Veindike" in *Economic Geology* in March, 1925, he describes in detail the ore-occurrence of this famous mine.

The bedrocks are sediments of Algonkian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary ages; these are generally covered by Tertiary outpourings of extrusives in great variety, and intruded by several kinds of Tertiary rocks. The oldest rocks are a great series of Algonkian sediments, highly metamorphosed into hard quartzites and slates, steeply tilted and forming the impressive cliffs along the Uncompahgre Canyon above Ouray. After this tilting and a long period of erosion, an immense thickness of sediments was deposited, ranging through the ages mentioned. These now dip gently away from the volcanic center in all directions and are well exposed around the edges of the district and in the beautiful cliffs surrounding Ouray, but are covered by the volcanics in the center. The final stages as now known were great volcanic outbursts in Tertiary time.

These formed great thicknesses of horizontally bedded rocks consisting of andesitic tuffs, breccias, and flows, locally called the "andesite," capped by a series of rhyolitic flows and tuffs called the "rhyolite." The late intrusives, of quartz monzonite, andesite, rhyolite, and others, are found in both the sediments and the volcanics, as dikes, crosscutting bodies, sheets, sills, laccoliths, and masses; as might be expected, they can frequently be correlated with the ore deposits. Other features are enormous rock slides, great talus slopes, extensive hot springs at Ouray, glacial till, late gravels carrying placer gold, and late landslides. Placer gold is found in several small rich deposits and a few large low-grade beds, but little production has been made.

Fissure Veins and Replacement Deposits

The ore deposits are of two principal types: fissure veins and replacements. Most of the production has come from fissure veins in the andesite, where mines like the Camp Bird, Atlas, Revenue, Mountain Top, and Barstow are typical fissures of steep dip carrying gold, silver, lead, and zinc in a quartz gangue, the ore being usually 3 to 5 ft. wide. The Red Mountain mines, like the Guston, are a separate group where chimneys of rich copper-silver ore occur as swells in fissures through the andesite. The Algonkian quartzites contain a number of small fissures carrying good ore in narrow veins. Several mines like the Bachelor have developed rich silver-lead-zinc ore in fissures cutting the later sediments. These sometimes border on replacement types of deposit because of impregnation of wall rocks and the more soluble beds through which they pass.

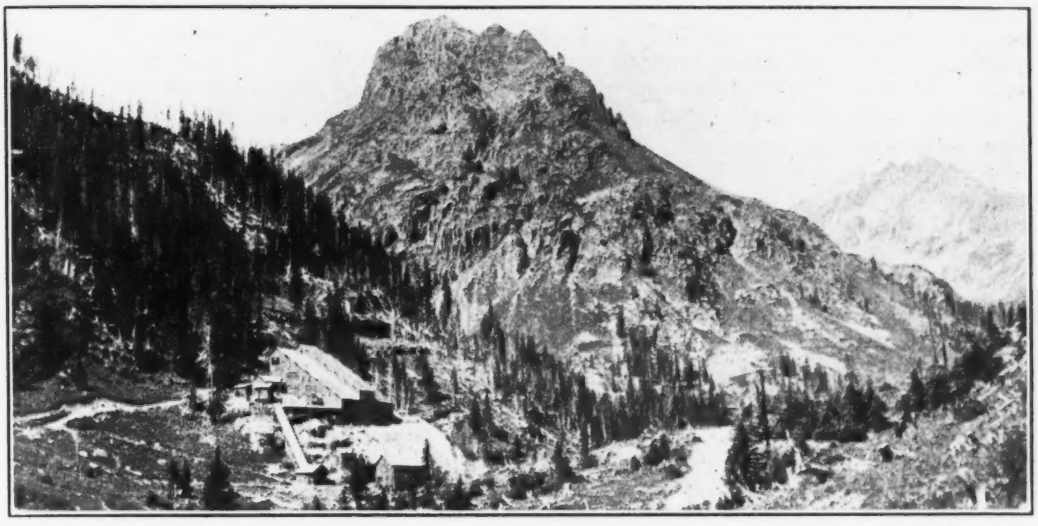
The replacement type of deposit also shows several varieties. The Mineral Farm type forms lead-silver

Snow-covered Red Mountain

ore in irregular and uncertain replacements of limestone along the course of fissures. The Newsboy type forms a more definite replacement of limestone of later age along straight, well-defined vertical fissures, by a siliceous silver ore. The Bright Diamond and Nettie type is a replacement of still later limestones and quartzites by pyrite, along dikes which have induced contact metamorphism over considerable areas. These deposits have been the source of important gold mines.

Typical downward enrichment by meteoric waters is not well developed. Owing to the rapid erosion of the country, there is no extensive surface oxidation and the ores are universally sulphides. Certain silver orebodies seem to be typical cases of secondary sulphide enrichment; the Red Mountain orebodies have been placed in this class by the U. S. Geological Survey, and a few of the Lake City orebodies have been so classified. The rather abrupt termination of other orebodies in depth is usually ascribed to other causes.

Fluorspar has been developed commercially in two mines and is being shipped today from a mine on Mount Hayden. During the World War fluorspar was shipped in quantity from the Barstow. Both these deposits are in fissures in the andesite. Vanadium is mined in San Miguel County from irregular deposits in sandstone.



Concentrator of the Atlas Mining and Milling Co.

Ore is brought from the mine, situated beyond the limits of the picture to the left, by an aërial tram.

Present Output Small

The district is now making a smaller output than for years. Exploration and development have been checked to such an extent that many of the larger mines are not in condition to maintain suitable tonnage and grade. In the Sneffels district, the Camp Bird is idle, although underground maintenance is being carried on. The Atlas, under Fred Carroll, and the Mountain Top, under George H. Beebe, are making only a small production, following recent curtailments. In the Red Mountain district, however, ore is being shipped from the San Antonio, under William Rathmell; active work is under way at the Guston, under Frank Ross; and the Barstow is making a larger output than usual, under C. R. Wilfley and Johnson & Horn, leasers. Prospecting is going on in several places in this district, including the Laura Dunmore, under H. C. Gandrup. Among the mines in the sedimentary rocks below Ouray, the Bachelor Consolidated, under George H. Beebe, has just completed a long adit to cut the vein below the limestone ore horizon; excellent indications warranted the driving of a raise to the limestone, and this work is now in progress. The Z.A.D.B. Mining Co., under John Zanett, is organizing to work ground east of the Bachelor; leasers on the Bachelor have maintained a small output of good ore. John Martin has been shipping good ore from this district, and various prospecting operations give good promise. In the Mount Hayden district, fluorspar is being shipped under operations directed by W. E. McCullough, and the Sutton mine is preparing to drive a 2,000-ft. adit on the Denver, a lead-zinc vein.

Need for Exploration and Developments

Exploration has been carried on in recent years to prospect several mines at greater depth. The net result has been no discovery of large orebodies. Prospecting has been mostly confined to annual assessment work rather than to new work, and leasing has been mostly the taking out of ore from well-known territory.

The most notable work has been the driving of a two-mile adit by the Camp Bird, cutting the vein several hundred feet below the old workings. This adit, all in andesite, intersected several other veins, none of which was worked. The Camp Bird annual reports stated that no important orebodies were found. At the Revenue mine, drifting at a deep level did not disclose ore of consequence. Exploration in the Red Mountain district has attracted a deserved interest, but has not resulted in important discoveries. Considerable work several years ago at the Yankee Girl by George E. Collins of Denver produced an appreciable amount of ore, but did not result in continued output. New work is now being projected, however. The most important work now going on looking toward development of geologic problems is the exploration of the Bachelor vein at depth by the Bachelor Consolidated, but the objective has not yet been reached.

Most of the mines are exploited through adits, as

the topography favors this. Shafts at underground stations are frequently necessary in the later stages of development, because the ore usually persists below the level at which adits of reasonable length can be driven. Consequently there are few large hoist or pumping plants. Underground haulage is usually done by mules. The Revenue and Camp Bird new adits use electric trolley locomotives, and the Atlas uses storage battery locomotives. Timbering, which is done with native material, is mostly in drifts, shafts, raises, and chutes of ordinary type. Stone ore passes have been used by the Atlas. Stoping in the fissure veins is usually overhand, with waste filling from walls, the larger mines sometimes supplying fill through passes bringing waste from other parts of the mine. Shrinkage stopes are often used, particularly in the larger mines, most of them adopting both types, according to conditions. Open stopes are rarely seen. The flat deposits are mined by ordinary methods, with a relatively small number of pillars and little timbering. Drills are mostly of the hammer type. Mucking machines have been used to only a small extent, and then only experimentally.

Cyaniding and Flotation

Concentration, sometimes preceded by amalgamation, is the universal method of local ore treatment. The ores are practically all sulphides with little oxidized mineral, and the usual practice is gravity concentration on tables of the Wilfley type followed by flotation. Most of the gold ores yield an important part of their gold to amalgamation, so that well-organized plants find it advantageous to use this process before concentration; the smaller plants, which run shorter campaigns, prefer simple concentration.

Cyaniding has been an important factor in the metallurgy of the San Juan, but is not practiced now. It was developed to a high degree by Woods, Herron, Caetani, Reed, Chase, Weinig, and others, and was in use at the Camp Bird when the mill was shut down in 1916. The last and most interesting development was the work of Weinig at the Liberty Bell mill at Telluride, where the ore was concentrated, rejecting a tailing, and the concentrate was ground and cyanided, reducing the entire output to bullion.

The Camp Bird practice always employed cyanidation except for a short period at first. The original cyanide treatment was a double-treatment sand leaching plant handling tailings from stamps, amalgamating plates, Frue vanners, and Wilfley tables. Throughout the entire subsequent production period, substantially the same practice was employed, and was developed to a high degree of efficiency by Thomas H. Woods, superintendent. This consisted of reduction in crushers and sixty 1,050-lb. stamps, plate amalgamation, table concentration, classification with coarse product to Huntington regrinders, second amalgamation and concentration, and all tailings to cyanide plant of usual type. The extraction of gold was 96 per cent. The following figures, covering the major part of the entire production, give the details of the mill products, all ore having been milled and none shipped direct: The ratio of concentration was 10.24 to 1. Of gross value recovered, gold was 94.20 per cent, silver 3.96, lead 1.46, and copper 0.38. Amalgamation accounted for 70.5 per cent of the recovery, concentration 22.3, and cyanidation 7.2.

The development of flotation was due largely to pioneering by the Atlas M. & M. Co., under Fred Carroll. In 1912, under License No. 3 from Minerals Separation North American Corporation, the company began operating the first commercial, cold non-acid plant in the United States. (Licenses 1 and 2 had been issued to Canadian and Cuban operators.) Since then Mr. Carroll has actively and continuously developed the application of the process and achieved a high degree of efficiency, the latest work being the use of xanthate in separating lead and zinc into two salable products, and the discarding of the iron. The Sunnyside, at Silverton, has developed the separation of lead and zinc to a high degree and is now making large shipments of both products. The problem of lead and zinc separation, always troublesome in this region, has received great help by the development of the sulphating process at the Durango smelting plant. Zinc is dissolved and kept out of the lead-smelting furnaces.

An Underground Concentrator

The underground mill at the Mountain Top, designed and built in 1916 by G. H. Barnhart, then manager, is an unusual and novel plant. The mine is above timber line in a bleak region of snowslides, and the small size of mill did not justify a long tramway; nor did any suitable site offer on the surface near the mine. The mill was built inside the mine, 1,800 ft. underground. It consists of an incline excavated in the country rock at one side of and communicating with the main adit, with a series of chambers staggered along both sides of this incline, housing the individual machines. The ore is hoisted through a short raise from the adit to the head of the incline, then runs by gravity through the plant, which consists of crusher, small ball mill, tables, pneumatic flotation machine, settling tanks for concentrate, and pump for discharging tailing through a pipeline laid in the adit and discharging at the portal. The mill has operated successfully ever since its erection with no trouble from tailing disposal and no expense for heating, insurance, and building maintenance.

The newer mills use ball mills for fine crushing, but the older mills retain their stamps, usually with ball mills for final stages. Stamp milling was highly developed at one time, and besides being a steady, reliable means of ore reduction, it was suitable for the amalgamation practiced by many plants. A Huff electrostatic plant was operated in Ouray for a short time by David Foerster on concentrates and good separations of lead and zinc were made, but the plant was not a financial success. It was made into a custom assay office, where for twelve years or more Mr. Foerster has been the principal local assayer.

General Conditions

General conditions are about on a par with other Western districts. Freight and smelter rates, wages, and cost of supplies remain fairly high, expert miners are rather scarce, and new money for exploration and development is not plentiful. Leasers serve usefully to keep the mines open and to retain good miners in the district while they make an appreciable output of ore and make better than wages for themselves.

Practically all power is electric, supplied over 17,000-volt lines by the Western Colorado Power Co., with a wide distribution and excellent service, considering the rough country traversed. Ore and supplies are handled by wagons and sleds, or packtrains, except in a few

cases where the plants are on the railroads. Automobile trucks are used but little, because few of the roads are suitable and winter conditions are too severe. A picturesque remembrance of the visitor, as well as of all operators, is the prodigious feats and the reliable performance of the "six-teams" and packtrains of John Ashenfelter and his successor of today, John Donald. Five of these hardy men with thirty-six horses were swept to death at one time in the now famous "Waterhole" snowslide on the Camp Bird road, years ago, but despite such experiences and difficulties no mine need worry about safe and reliable transportation of ore and supplies. Transportation is maintained through the winter on the main roads, but the smaller mines, not on such roads, find it necessary to stock their heavy supplies in advance. Snowfall is very heavy, but varies with the altitude; mines within a few miles of each other have vastly different quantities of snow to deal with, the mines below Ouray, for instance, having no trouble from snow whatever. The aërial tramway was developed in the early days in this country and has done a great deal to solve the problem of cheap transportation from mine to mill, for many mills are situated some distance from the mines.

Industrial relations are satisfactory. Ouray has never been the victim of serious labor troubles, though troubles have occurred in other parts of the San Juan. Wages follow the general level in Colorado and are influenced to some extent by labor union action taken by locals in other parts of the San Juan. Much work, especially in the larger mines, is done by contract, stoping being paid for by the fathom and drifting and raising by the foot, some contractors making excellent pay. The Colorado workmen's compensation law is working satisfactorily for both sides, the state fund carrying a large share of the business. A hospital with good equipment is maintained in Ouray.

The most important problem affecting the prosperity of the district is the development of ore. Beyond question the glorious days and deeds of Tom Walsh, A. E. Reynolds, and the other bonanza operators are gone, as are most of those men; no longer are huge bonanzas readily to be found, nor is money so freely supplied for hunting them. Considered as a whole, the district was well prospected by hardy and intelligent men in the early days and it has long been in the hands of capable men, so that the easily found ore has been discovered and the economic problems have been reduced to their simplest terms. There is still developed "ore" in mines that have suspended because the cost of operation now takes all the profit from material which was formerly profitable, but the great need is for more development of these mines and for the exploration of undeveloped prospects.

Possibility of Future Prosperity

The mines which have already yielded large amounts of ore are in few cases developed or explored far beyond the limits of the last known ore, especially in depth. In some cases this was due to the natural increase in cost and physical difficulties of mining at greater depth and distance; in more recent cases it was due to the same cause plus the increase in cost of supplies and wages. In addition to this there is a feeling among well-informed men that the rich ore does not as a rule extend much below a certain depth in the fissure veins in the andesite; this seems to be fairly well proved as regards the rich orebodies, but the question of just what these veins will develop below that horizon has not been well tested. The evidence indicates that the fissures themselves persist downward for great distances, and if the local enrichment is due to the influence of wall rock, there is still the possibility of similar enrichments lower down, in similar rock. On the whole, there is undoubtedly a good deal of excellent ground yet undeveloped around the older mines, but its development means the expenditure of considerable money under well-organized plans.

The opening up of prospects and the development of the smaller mines is a wider field, somewhat more speculative, of course, but with possibilities. In the more remote parts of the district there are veins giving good indications that have had very little real work done on them because of their inaccessibility; doubtless some of these will one day be mines. In the more accessible parts of the district are a good many prospects that have had more work done on them, but much of it represents scattered effort; many of these are, of course, worthless, as proved by the work that has been done, but some of them give promising indications and merit more thorough exploration. Among these can be classed the small mines, which have developed and produced good ore; some of these are undoubtedly of a pockety nature and risky in the extreme, but all over the district are small mines that warrant further development, and a few that would very likely make good mines if development were carried far enough to put them in shape for continuous production. Among these last may be classed a few lead-zinc mines where ore has been exposed in the easiest places to get at and then gouged for a small yield of sorted lead ore to make shipments direct to the smelter. Development would be likely to expose enough ore to supply a small mill.

Mining Industry Growing in Manchuria

The Anshan Iron & Steel Works, operated by the South Manchuria Railway Co., is at Anshan, near the famous old town of Liaoyang, south of Mukden. The Anshan district abounds in iron and coal, the Yentai coal mine of the railway company being in this same neighborhood, according to the *Far Eastern Review*. Iron ore is especially abundant, though not of high grade. It is mostly hematite, with a sprinkling of magnetite, containing about 40 per cent of metal. The deposits in the district are estimated at 200,000,000 tons.

Two blast furnaces have been installed at Anshan, and 74,528 tons of pig iron was produced in the fiscal year ended March 31, 1923. The plant has 25 miles of railway in operation.

Because of the relatively small iron deposits of Japan, the South Manchuria Railway Co. is giving much attention to the best development of the resources at Anshan. The latest budget of the company called for several million dollars for extension and improvement of the plant. Officials and employees of the steel works number about 2,500 Japanese and Chinese. Extensive iron-ore deposits are also found along with the coal at Penhsihu, between Antung and Mukden, but these likewise are of low grade.

Before the introduction of foreign capital for the development of Manchuria's mineral resources, gold was the only metal extensively mined.

Useful Operating Ideas

Portable Compressor Rig for Prospecting

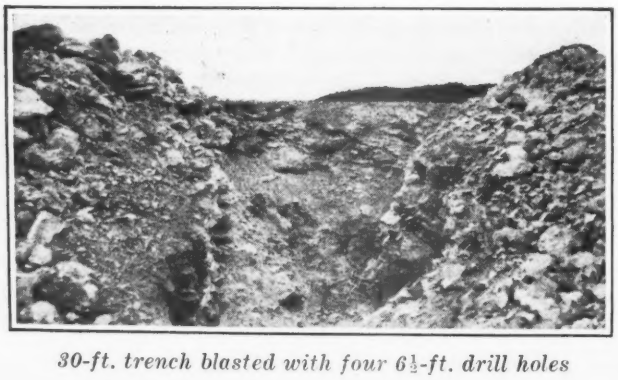
At the Foster mines, Shadow Mountain, San Bernardino County, Calif., a light, portable compressor plant for surface prospecting work has been found use-

General view of compressor outfit

ful. A Maxwell 1916 touring car was used, the rear seat being removed and a Gardner GL 6x4½-in. vertical single-stage compressor mounted on a plank base bolted to the frame. A No. 2 Gould pump furnished water circulation through a Ford radiator. The receiver is 12x36 in. and is equipped with a pop valve, set at 105 lb., and a gage.

Power is transmitted to the compressor through a shaft mounted on two 6-in. hangers with 5-in. self-aligning bearings, equipped with three 10-in. diameter, 5-in. crown face American split steel pulley with 5-in. four-ply rubber belting to the 20-in. pulley flywheel on the compressor. The hangers are mounted on two skids 3 ft. long, 3x4 in., the front ends being bolted to a plank about 7 ft. long and 12 in. wide. The car is hoisted or jacked up and steel jacks set under the rear axle resting on the plank. The drive pulleys are adjusted against the tires with a turnbuckle on each side of the car attached to the skid and running to an eye in the running board. Blocks are inserted between the springs, front and back, to reduce vibration, and the belt is tightened by two 2x2-in. strips braced under the upper part of the body.

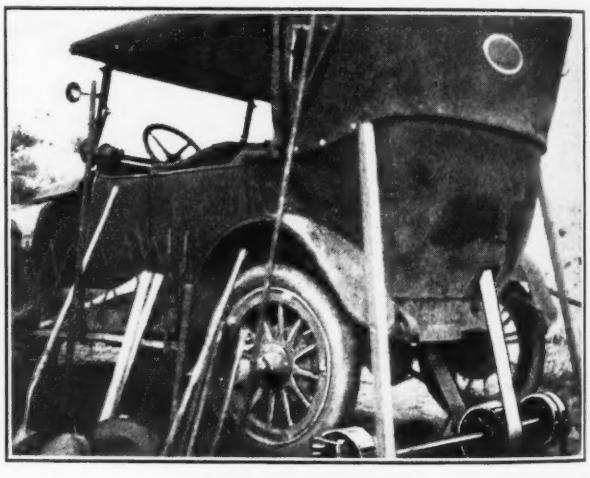
The car is capable of carrying all the equipment



30-ft. trench blasted with four 6½-ft. drill holes

necessary, but another car is used, as it is handier to remove material from the Ford when getting ready to set up. Fifteen to twenty minutes is required to set up and start operation. Five gallons of gasoline will drill from 100 to 200 ft. of hole, and about 5 gal. of water is consumed in cooling the engine. The engineer starts the load in high and the pressure is maintained up to 105 lb. without difficulty. The engine will not run to capacity, due to vibration, but in practice four 6½-ft. holes per hour can be drilled in hard ground. A No. 36 Cochise jackhammer was used. An average of twenty minutes is required to dismantle the unit and get ready to move. The drill operates satisfactorily at the end of 100 ft. of hose, but is inefficient at 150 ft.

On the Mojave-Rand property at Randsburg, Calif., twenty-eight holes 6½ ft. deep were drilled in lime silicates, loaded, and shot in ten hours. At Rosamond, Calif, in hard quartz-porphyry 93 ft. of hole was drilled, loaded, and shot in eight hours, including set-up and



Auxiliary shaft drive

dismantling. Six of these holes were drilled 6½ ft. deep. The entire equipment weighs less than 1,000 lb. The car can go into almost inaccessible places, and maintains average speed on roads.

Electric Blasting in the Engels Mine

By W. R. Lindsay

Although electrical blasting has been more or less generally employed in shafts, raises, and tunnels for a number of years, the practice in metal mines of firing all shots by electricity has not until recently been seriously considered. The idea has often been discussed and its possibilities considered at the Engels copper mine in California, but because of the apparent difficulty of educating the ever-changing crew of miners, it had not been attempted.

Stoping at the Engels mine is by the shrinkage method. Under the former plan of operations, one shift started at 7:20 a.m., and the other at 6:05 p.m., each shift following the same procedure. Pipe lines were

laid across the stope while the miners were taking down loose rock. Machines were then set up with the help of jackhammer men, who finished barring down any loose rock after the machines were started. They then drilled the boulders and blasted at the same time as the miners.

Under these conditions an average of only 45 to 50 ft. per shift could be drilled from one set-up. Often there would be time to drill one or perhaps several additional holes, but it was difficult to get miners to set up and tear down the machine for a few more holes. In order to take full advantage of the increased drilling speed of the latest type of hammer drills it was decided to organize two drilling shifts and to establish a third shift exclusively for blasting. Under this plan considerable time which had formerly been taken up in loading and blasting was now devoted to drilling, and this naturally led to the consideration of electrical blasting as a means of allowing a smaller number of men to accomplish all of the blasting throughout the mine.

Under the new plan the first shift starts at the same time in the morning, the second at 4:30 p.m. and the blasting shift at 8 p.m. The procedure for the first shift is the same as before, but if a miner cannot get over 60 to 65 ft. of drilling from one set-up, he sets up again, and, drilling as much as he can, leaves the remainder for the next shift to finish. The second shift, finding the machines set up, finishes the rounds and sets up for another. After the last round is finished, the crew tears down and puts the machine away in time to leave with the shift. The major portion of the blockholing is finished on the first shift, and the jackhammer men on the second shift complete it, after which they help the blasters until it is time to take the pipes out of the stopes.

Taking one stope at a time, in February, 1924, a series of tests was carried out in order to determine just what results could be obtained. The tests were made in every stope in the mine, as well as in the upper levels where pillars were being removed. That the new method offered considerable advantage over the old procedure soon became apparent. More ore was broken; the rock was broken finer, thus reducing jackhammer blockholing, which had always been a problem in this mine; the back of the stopes are also trimmed cleaner, leaving less loose rock to be subsequently barred down. At the expiration of these tests, the general results were such as to warrant the complete adoption of the method in one mine. The other mine presents an altogether different problem, and additional experiments to be made at a future date will be necessary to determine the best procedure.

Under the electrical method of blasting, four men working in pairs, with such assistance in loading as they receive from the jackhammer men on the second shift, do all the blasting for from twenty-six to thirty-two machine shifts and eight to twelve jackhammer shifts per twenty-four hours. All blasting is done after the drilling shift leaves the mine.

Electric current for blasting is taken from a 220-volt a.c. power circuit controlled by a single throw, two pole, fused switch, inclosed in a metal box which can be locked only when the switch is open. The key to this box is in the possession of the shifter in charge of the blasting shift. The wires are carried in conduit up the manways to terminal boxes at the entrance to the stopes. All stopes on any level are fired at one time from the switch box on the level. From the firing box to the stope entrance box No. 10 galvanized wire is used, whereas in the stope itself No. 20 connecting wire is used. By this arrangement the danger of connecting to a live wire is eliminated, as the connection to the source of current is always kept locked, and, in addition, a second safeguard is provided by the stope entrance box, which is always under observation by men working in the stope. After the entire stope is loaded and connected, connections between the blasting circuit in the stope and the blasting line from the firing switch are made in the stope entrance box.

Connections in the stope are made in multiple series —that is, electric blasting caps are connected in series up to about thirty caps in each series, and the different series are connected in multiple. This method was found to save considerable time over a straight multiple connection. With four stopes and as many as ninety to a hundred holes in the large stope, probably not less than 300 holes have been fired at one and the same time by this method. For development work, straight series connections and a push-down type of blasting machine are used. For blockholing in the chutes, single caps fired with twist-type, permanent magnet pocket machines are used. It has been found that this method involves less blasting than by cap and fuse, as the chute blasters are more careful in getting the powder where it will do the most good.

Electric blasting caps, No. 8 instantaneous, are used in stope blasting 4 ft. copper wires for blockholing, and 10 ft. copper wires for blasting down the back. Where several rows of holes in tight ground are to be blasted, No. 8 delay electric blasting caps are used. Delay electric blasting caps are never employed in the same series in conjunction with instantaneous electric blasting caps. They may be put in a separate series and that series connected in multiple with other series containing instantaneous electric blasting caps. For development work, delay electric blasting caps and no-delays are used. All caps are tested with a galvanometer before being taken into the mine, and the ends of the wires are cleaned. This saves the time of the men in connecting up and prevents failures due to broken bridge wires that may have been broken in transit or by handling.

The following enumerates the advantages as found after trial of the electrical method: 1. More ore is broken per foot of drill hole and per pound of powder. 2. There is less loose and dangerous back to bar down. 3. The additional safety that always accompanies electric blasting is obtained. 4. As all blasting is done by the same crew and under the supervision of one man, more efficient use of powder is obtained. 5 The machine drilling, which amounts to about one-half the mining cost, is accomplished more efficiently. 6. There is less smoke and gas due to the elimination of fuse.

Acknowledgment is made to J. T. Collins, of the Hercules Powder Co., and to E. L. Watts, of the California Cap Co., for their co-operation and help in successfully working out the details of the method.

Grinding Cement

Fine grinding of portland cement increases its strength, especially with rich mixtures. Concrete made with fine ground cement is stronger than with the coarser cements. Cement manufacturers have increased the degree of fineness of their cements until the present national standard is 78 per cent passing a standard cement screen having 40,000 openings per square inch.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Zinc Smelters in Europe

THE EDITOR:

Sir—In *Mining Journal-Press* dated Aug. 29, 1925, we noted that in reply to an inquiry by an ore producer of Central America you published a list of concerns possibly interested in zinc ores, stating in fourth rank the name and address of our company, as follows: Soc. Anon. de la Vieille Montagne, Viviez, Aveyron, France. We would observe that this is merely the location of one of our six smelters (three in Belgium, two in France, and one in Germany), and that all our purchases are made by our central offices, with headquarters at Angleur par Chênée, Belgium, which address should appear in all information regarding our company.

In addition to the foregoing, we would point out that although you specified in the aforesaid item that the listed concerns are both operators and brokers, we feel that clear discrimination ought to be expressed, to the benefit both of the miners and the smelters who are direct consumers. In this respect we beg to state that we are the most important zinc concern in Europe from the viewpoint of consumption of raw material and of the output of spelter too.

Société Anonyme des Mines & Fonderies de Zinc de la Vieille Montagne,
SAINT PAUL DE SINCAY,
Chênée, Belgium. General Managing Director.

Atomic Structure of Crystals a Mystery

THE EDITOR:

Sir—In the article in *Mining Journal-Press* of Sept. 12, headed "Froth Flotation Explained by X-Ray," Mr. C. G. McLachlan may be right when he suggests that the reason for non-flotation of such minerals as cuprite and carbonates is the oxygen atoms they contain. If he ascribes this non-flotation to the presence of oxygen in the surfaces of the crystal space lattices, however, one gets the impression that only those atoms shown on the surfaces of the diagrams could occur on the surfaces of crystals; for example, oxygen atoms in Fig. 5, representing cuprite.

Suppose that such a crystal is crushed, as it certainly will be: does this mean that only atoms of oxygen will be on the surfaces of the fragments? This could happen only if the oxygen atoms were split through the middle. Mr. McLachlan seems to have overlooked the fact that *any* point in a space lattice (which for our purposes extends to infinity in all directions) can be made the starting point or corner for a unit cell diagram without changing the conception of crystal structure in the least. In the example of cuprite it would be just as true a diagram of the crystal structure if we started with a copper atom at the point of intersection of the space co-ordinates, though it would not be the conventional way of representing the unit cell of cuprite.

So far we know practically nothing about the way minerals break or cleave with respect to crystal structure. In a number of instances, cleavage is parallel to planes which have the densest spacing of atoms (the greatest reticular density), but there are many exceptions. In any case, however, it would be impossible for cleavage pieces or other fragments to have just one kind of atoms exposed on one side of the break; or, still more impossible, the same kind of atoms on both sides of the fracture (native elements excepted): but that is just what would have to happen if the "faces of chalcopyrite and pyrite are composed of metal atoms . . ." and "that oxygen and not sulphur atoms are present in the crystal faces of these minerals" (referring to the figures of the oxides of copper, zinc, and arsenic).

It seems, therefore, from these considerations that it is absolutely unknown what kind and combination of atoms are in the boundaries of crystals and of their fragments. How can froth flotation be explained by crystallography, then, at the present stage of our knowledge of crystal structure?

Minneapolis. JOHN W. GRUNER,
University of Minnesota.

Prospector and Philosopher

THE EDITOR:

Sir—In reading "What Ails Prospectors and Prospecting," in the Sept. 19 issue of *Mining Journal-Press*, one can scarcely fail to lay aside the subject in hand and feel a start of surprise at encountering so near a gem of literature and philosophy written by one ostensibly so far removed from cultural activity. Indeed it would seem that this prospector is not only endowed with an acute sense of humor, but, in addition, a bit of the poetic, and, withal, the happy faculty of setting it entertainingly to words.

As "to those engineers, and a geologist or two," that he has had the good fortune to meet, it seems a corollary that they should feel more traveled, had seen more, and knew more, after meeting this philosophical prospector. Without doubt they left him with a deal of regret, and with a broader outlook on this life.

One of the redeeming features of life in a mining camp is the chance acquaintance and pleasant evenings spent about the fireside in contact with itinerant personalities that are born of experience and educated by the vagaries of Mother Nature.

In quest of his next grubstake our prospector should be able to recount a few of his adventures in a way that could hardly fail to arouse the interest of some busy editor; and his dextrous pen should compare favorably with many an opulent writer of present-day narrative. Furthermore, his efforts would be cast in competition with a class above that of the squalid immigrant from the Balkans. AN ENGINEER.

Moundville, Mo.

The Fault and the Doodle-Bug

THE EDITOR:

Sir—There have been frequent requests for some machine for aiding the prospector in finding minerals, and descriptions of such apparatus, but I have not yet seen detailed instructions for the operation of one I saw used a few years ago by a high official of an important mining company in locating the faulted portion of a vein.

In the instructions given by the correspondence school which I "attended," no mention was made of this wonderful little device, nor have I found any information about it in the books on geology, ore deposits, etc., which I have found time to read. When I was a boy I saw it used for locating water, but I did not know until the time mentioned that it would work just as well in the search for minerals. I recently heard that this same gentleman has tried it in search for oil with equally marvelous results.

The day it was tried out in the drift where the vein was lost, it pointed out the lost portion in the same direction and at about the same place on several different trials. But there must still be a great deal of movement going on in that mine. A few days later this gentleman was being shown through, and as they happened into this drift (they came in from another direction) he tried out his machine and again located the lost vein; but during these few days it had been thrown to the opposite side of the drift.

The device consists of a small forked branch of a peach tree, or other tree which bears a fruit with a contained kernel similar to the peach. The operator holds one branch of the fork in each hand with the free end or "handle" pointing up. He walks along repeating in a low voice some words or phrases (I could not catch what he said), and when he gets near water or mineral, as the case may be, the free end will turn toward it.

To make it "hunt mineral" instead of water, just split the "pointer end" and insert a silver coin. I do not know what "adjustments" are necessary to make it adaptable for locating oil.

Is it the words repeated that make it effective? If so, what are they, or does one have to be gifted with supernatural powers to operate it? Does the branch have to be cut at any certain time of the moon, and can anyone learn to "work it" the same as we learn to push a car, run a drill, a surveyor's transit, etc.?

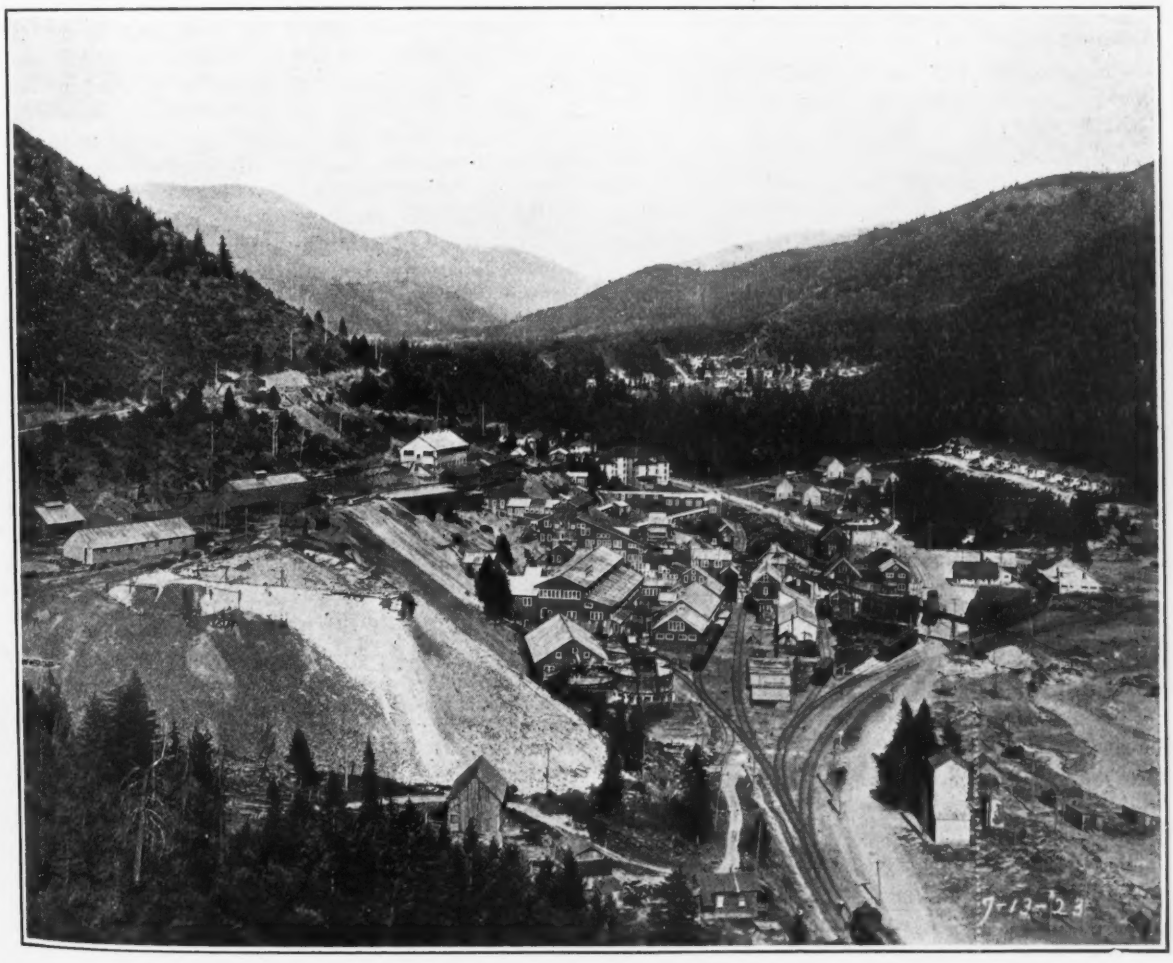
Saltillo, Coahuila, Mexico. A MINER.

The Morning Mine

THE EDITOR:

Sir—I note that the picture of the Morning plant published in the issue of Sept. 12 with the very interesting article by A. B. Parsons was quite an old one and I am, therefore, inclosing herewith a more recent picture of the plant that you may possibly like to use.

Wallace, Idaho. H. G. WASHBURN.



The Morning mine plant at Mullan, Idaho, looking east

Consultation

Montana's Mine Production

"Can you tell me the gross value of the metal produced by the mines of Butte, Mont.?"

We have no trustworthy record of the production of Butte mines alone, but George W. Craven, director of the Montana State Bureau of Mines, has prepared the following estimates of the gross value of various minerals produced in the entire state. The figures follow:

Copper	$1,334,960,000
Silver	382,139,550
Gold	208,239,742
Zinc	138,772,092
Coal	127,280,609
Lead	11,535,990
Manganese	9,605,343
Sapphires	2,420,000
Total	$2,214,953,326

Rapid Test for Gold in Cyanide Solutions

"Can you give me a rapid and trustworthy method for testing the efficiency of precipitation of gold by zinc in cyanide plants?"

The following procedure is described by John Dixon as giving reliable results in the plant of the Kirkland Lake Gold Mining Co., in Ontario:

Take 750 c.c. of solution to be tested in a 1,000-c.c. Erlenmeyer flask (a painted mark on the flask makes it easily measured). Add 20 c.c. saturated cyanide solution and two to four drops of saturated lead acetate solution. Shake well. Add 0.5 gram of zinc dust and shake until the lead sponge is formed, and invert in a 3-in. porcelain casserole. Let air into the flask until the casserole is half full and allow the sponge to settle out into the casserole.

After the sponge has settled, remove the mouth of the flask quickly from the casserole and allow the solution to run to waste. Decant the remainder of the solution from the sponge in the casserole and add 10 c.c. aqua regia (under a hood). Evaporate until a thick brown sirup remains. Add 5 c.c. conc. HCl and evaporate until 5 c.c. remains. Pour into a test tube and cool under the tap. Allow the precipitate of lead chloride to settle and add two to four drops of stannous chloride from a dropper. From the color ring formed, estimate the gold in the sample.

	Per Ton Cents
Colorless	0
Straw yellow	0 to 2
Light purple	2 to 4
Dark purple	over 6

The color disappears quickly, but can be brought back again by adding more stannous chloride.

Reagents: Aqua regia; 7 parts conc. HNO_3 to 3 parts conc. HCl.

Stannous chloride: Make a saturated solution of the c.p. salt in 1 part conc. HCl and 15 parts distilled water. Place a few shavings of metallic tin in the bottle to keep it in stannous form. Not over two weeks' supply of stannous chloride should be prepared at a time, as it deteriorates on standing.

If a hot plate is not available, a soldering torch furnishes a satisfactory heater if the casserole is set in a hole cut in a piece of asbestos board to prevent the direct flame from striking against the sides of the casserole.

The determination can be made in about fifteen minutes and if desirable several samples can be handled at the same time.

Abandonment vs. Forfeiture

"Can you explain for me the distinction between the terms 'Abandonment' and 'Forfeiture' in connection with mining claims?"

According to "A Glossary of the Mining and Mineral Industry," by A. H. Fay, the essential distinction is one of intention on the part of the claim holder. The matter is elucidated in the following definitions:

"Abandonment of a mining claim may be by failure to perform work; by conveyance; by absence, and by lapse of time. The abandonment of a mining claim is a question of intent. To constitute an abandonment of a mining claim, there must be a going away, and a relinquishment of rights, with the intention never to return, and with a voluntary and independent purpose to surrender the location or claim to the next comer."

"Forfeiture of a mining claim takes place by operation of the law without regard to the intention of the locator whenever he fails or neglects to preserve his right by complying with the conditions imposed by law, and is made effectual by one who enters upon the ground after the expiration of the time within which the annual labor may be done, and completes a location before resumption of work by the original locator. A forfeiture of a mining claim consists in the consequence attached by law to certain facts, and the intention of the claimant as to whether or not a forfeiture in fact exists is wholly immaterial, and in this respect a forfeiture differs from abandonment."

Treating a Vanadium Concentrate

"I am interested in treating a vanadium concentrate which contains practically no other metal, using a wet (acid) extraction process, afterward precipitating as vanadate of iron, and reducing to ferrovanadium. The process is satisfactory in its recovery, but the finished product contains too much phosphorus. The concentrates contain about 0.40 per cent P_2O_5, and evidently this is extracted, and carried down in the precipitate. Can you inform me if there is any wet recovery known whereby the phosphorus is not carried through into the vanadate, or of any process in which it could be thrown out?"

If any reader would care to offer a suggestion in this connection *Mining Journal-Press* will be glad to publish it.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

UTAH METAL MINES pay dividends at rate of $13,000,000 per year, an excess of $3,500,000 over previous year. Silver King, Utah-Apex, and Keystone join dividend list. Others increase rates.

Bingham Mines Co. earns $7 per share as compared with $2 in 1924; now owns and controls 2,550 acres; producing at rate of 4,800 tons of lead and 1,236,000 oz. silver per year.

Teck-Hughes Gold Mines, Kirkland Lake, Ont., increases capital. Wright-Hargreaves applies flotation process saving at least $1 per ton.

Manganese ore produced profitably at Philipsburg, Mont., by Trout Mining Co.

Manganese mines on Cuyuna Range, Minn., have prosperous season. Only two small mines idle.

The Old Godiva mine, Eureka, Utah, acquired by Jackson McChrystal for immediate development in conjunction with U. S. S., R. & M. Co.

Research work by the Bureau of Mines basic; does not duplicate Standards' investigations. Survey reorganizes leasing division.

Judgment in case Iron Cap Copper Co. vs. Arizona Commercial Mining Co. modified by the Arizona Supreme Court.

Flotation plant, 250 tons capacity, planned for Leadville, based on Utah types of plants and flow sheets.

Consolidated Mining & Smelting Co. starts copper furnace, producing 25 tons blister copper per day.

Surface plant and shaft of Aztec mine, Oatman, Ariz., destroyed by fire; loss $50,000.

Consolidated Mining & Smelting Co. Starts Blast Furnace

Power Line to Mine Under Construction —Dunwell Mines Repair Plant and Resume Development

The Consolidated Mining & Smelting Co. of Canada has blown in one blast furnace, and expects to turn out about 25 tons of blister copper per day. The refinery has not yet been started. The company has a supply of gold-copper concentrate on hand, accumulated from the Rossland mines after the copper department at Trail had been closed. The future output of copper will depend for a time entirely upon the amount of concentrate received from the Allenby Copper Corporation, which, excepting the Rossland concentrate on hand, is the only immediate source of feed for the copper furnaces. At present the Allenby company is shipping 300 tons per week, but this, it is expected, will be more than doubled before the end of October. The Coast Copper Co., one of the Consolidated company's subsidiaries, is doing a considerable amount of development and exploration work at its Old Sport mine, on Quatsino Sound, Vancouver Island, and is making preliminary preparations to produce copper ore as soon as the condition of the market justifies, but before any output can be made a concentrating mill will have to be erected.

The Consolidated company has let a contract to Fred Belanger to clear a 17-mile right-of-way and place poles along it for a high-tension line to connect the East Kootenay Power Company's system, at Cranbrook, with the Consolidated company's St. Eugene mine, at Moyie. This line will provide power for a 500-ton mill that the Consolidated is erecting to treat the old "waste" dumps, which are said to contain about 8 oz. in silver per ton, and a considerable zinc and a low lead content. At the time that the mine was operated, zinc ore was thought to be valueless.

The new board of directors of Dunwell mines recently paid a visit to the company's mine, in the Bear River section of the Portland Canal mining division of British Columbia. After the inspection, Robert Stewart, president, announced that a crew of men would be put to work at once to repair the compressor, power plant, and the pipe line, and resume development work.

Teck-Hughes Offers Treasury Shares at $1.65

The shareholders of the Teck-Hughes Mine of Kirkland Lake, Ont., have received notification from the company offering treasury shares at $1.65 each. They have the right to subscribe for one new share for each twenty now held. The purpose of the issue is to reimburse the treasury for the heavy expenditures for the new shaft and mill enlargements, which have called for more than $300,000. The new shaft has been completed to 1,500 ft. and three new levels—the eleventh, twelfth, and thirteenth—will shortly be opened up. The mill enlargements will be completed before the end of the present month. The present issued capital is a little over 4,500,000 shares and 227,000 new shares will be issued.

Utah Mines Paying Larger Dividends Than in 1924

Bingham to Increase Disbursement Rate—Park City Distributes 70 Per Cent of Earnings

Dividends at the rate of approximately $13,000,000 annually were paid by Utah metal mines during the third quarter of 1925, as compared with total dividends of $9,700,000 for 1924. At this rate, which should be equaled or surpassed during the fourth quarter, Utah metal-mining dividends for the current year should exceed those of the year 1924 by $3,000,000 to $4,000,000.

Practically all of the Utah silver-lead producers are earning at a rate not exceeded during any year except the years of the late war. Several of them, including the Tintic Standard, the Silver King Coalition, the Utah Apex, the Bingham Mines, and the Park City Mining & Smelting Co., have created new individual records. With but nine months of the year gone, already three Utah mines have paid dividends in excess of $1,000,000. The Utah Copper has disbursed $4,873,470, the Tintic Standard $1,729,372, and the Silver King Coalition $1,094,450.

During 1925, two mines have increased their dividend rate—the Silver King Coalition from $243,200 to $304,025 quarterly and the Utah Apex from $132,050 to $184,870 quarterly. One mine, the Keystone, made its first appearance among the ranks of dividend payers with a disbursement of $67,500.

It is understood that the Bingham Mines Co. is planning to increase its

disbursement rate from 50c. to $1 quarterly on Jan. 1, 1926.

Shareholders of the Ontario Silver Mining Co. are invited to exchange their stock on the basis of one and one-half shares of Park Utah Consolidated Mines Co. for each share of Ontario, the basis on which acquisition of the two-thirds outstanding stock of Ontario company was secured. Ontario stockholders who make this exchange on or before Nov. 1 will receive a dividend of 15c. a share on the Park-Utah Consolidated Mines Co. shares so exchanged. This consolidation is in conformity with the program announced by George W. Lambourne, president of the Park-Utah company.

Both the Park-Utah Mining Co. and the Park City Mining & Smelting Co. during their existence created new dividend records for Utah companies. From 1921 to Aug. 1, 1925, the Park-Utah company paid 50 per cent of its net earnings, exclusive of depletion and dividends, or $1,296,036, out of earnings aggregating $2,588,793.

The Park City Mining & Smelting Co. bettered this record by paying more than 70 per cent of its net earnings, exclusive of depletion and dividends in the form of disbursements to stockholders, or $1,335,400 out of $1,744,536. This is doubtless the highest percentage of dividends based on net earnings to be paid by any Utah company.

Earnings of the Bingham Mines Co. are at the rate of $7 annually on the outstanding shares, as compared with $2 a share during the corresponding period of 1924. The increase in net earnings has been the result of larger output as well as higher prices for lead. During the first seven months of the year, production was at the rate of 9,600,000 lb. of lead annually and 1,236,000 oz. of silver.

Since the company's organization in 1908 it has retired bonds to the amount of $1,053,000; invested $187,000 in the Victoria property; $884,000 has been invested in the present 97 per cent equity of the Eagle & Blue Bell Mining Co.; $765,000 has been paid in dividends; and $1,583,000 for the purchase of 100,000 shares of stock for the treasury. The company now holds or controls a total of 2,550 acres, of which 975 acres has been purchased or contracted for during the present years. Payments have been arranged over a period of years so that they will not place too heavy an obligation upon the treasury.

Big Jim Mines, Inc., Constructing Mill at Harshaw, Ariz.

For several months the Big Jim mine, at Harshaw, Ariz., has been undergoing reorganization which has materially strengthened the company. Following the addition of W. J. Loring to the board of directors, a number of well-known southern California mining and oil men have entered the company. The mill to be erected on the Big Jim property will be moved from the Richardson estate, in the Harshaw district. Additional equipment to make it one of the most modern and best-equipped mills in the Southwest is already on the ground at Harshaw. The mine shaft has been retimbered, extraction raises have been run, and heavy rails laid in the levels. Electrical power will be supplied by the Southern Arizona Power Co.

The orebody of the Big Jim, which is an old mine formerly worked to a limited extent, is 42 ft. wide. It is estimated that there is now in sight sufficient ore for eighteen months' operations, with no further development work. While the mill is being built, however, the shaft will be sunk deeper, so that the lower levels will be ready to be worked when the ore in the present level is exhausted.

New Coolidge Dam Near San Carlos, Ariz., to Supply Cheap Power

THE proposed reservoir which is to be built on the Gila River about 10 miles from the San Carlos Indian Reservation will be almost identical in height with the Roosevelt Dam, according to Major Ohlberg, engineer in charge of the project. The dam, which will be known as the Coolidge dam, is to be built in a much wider canyon than are Roosevelt, Mormon Flats, and the Horse Mesa dams, on Salt River. It will take about two years to complete the construction.

About eighty thousand acres of land in the vicinity of Casa Grande and Florence and on the Pima Indian Reservation will be watered from the storage reservoir which the dam will provide. Congress has set aside $5,500,000 for the construction work. The dam site is about 45 miles from Globe, and much closer to the smelter town of Hayden and the mining camp of Ray. The power that will be produced will undoubtedly be of great value to the various copper companies in the vicinity.

Wright-Hargreaves Mine Reduces Tailing Losses

Some interesting work is being done at the Wright-Hargreaves mine in Kirkland Lake, Ont., in connection with the treatment of the ores, which promises results of great importance to the industry. The Kirkland Lake ores carry appreciable quantities of gold tellurides and the extraction has been far from satisfactory, high tailings being the rule rather than the exception. Finer grinding did not appear to be the solution of the problem and the high tailings losses were a matter of serious concern. Last year, at the Wright-Hargreaves property, heavy accumulation of froth was noticed on the Dorr thickeners. The froth assayed rich in gold. James Grant, the manager, started experimenting and arrangements were made to take the froth off at the cone classifier following the tube mills and this was run over blankets, with the result that concentrates were obtained, which at times ran several thousand dollars to the ton. The concentrates, however, would not give a satisfactory extraction by cyaniding without a preliminary roast, so the experiments, on a small scale, were continued.

Las summer, standard flotation units were installed having sufficient capacity to handle the entire tonnage of approximately 400 tons a day. No oil or emulsion of any sort was added, the only outside agency being compressed air from the blower. Large quantities of froth were obtained giving a concentrate averaging approximately $250 a ton, but the treatment was still a problem. In the meantime, W. E. Simpson collaborated with James Grant, manager of the Wright-Hargreaves, and it was decided to try bromo cyanide. Experiments to date indicate a remarkable extraction, which is obtained in two or three hours, with the bromo cyanide. It appears that in addition to the flotation cells the only new equipment needed is a small tank for the treatment of the concentrate, the pulp bypassing the agitators and being introduced into the last tank before the precipitation filters. Although it is as yet too early to make definite statements as to what effect this new process may have, it has already resulted in lower tailings losses, and shows every indication of being a valuable contribution to the metallurgy of Kirkland Lake ores. The saving should be about $1 per ton.

Sulphide Ore Roasted Underground Preliminary to Leaching

According to William Saundercock, superintendent in charge of the workings of the Copper Belle mine of the Shannon Copper Co., at Gleeson, Ariz., the "man-made" fire in the sulphide orebodies is still burning, with no sign of abatement. Mr. Saundercock says there is no way of estimating when the sulphides will have burned themselves out, although the burning operations are being watched as closely as possible. It is, however, impossible to get into or near the workings, where the ores are burning, although from the smoke and fumes which are emitted from the shaft it is known that the sulphide veins between the 400 and the 100 are still burning.

Setting fire to the sulphide orebodies over a year ago, for the purpose of leaching the ore underground, is believed to be the first experiment of its kind ever attempted. When it is finally decided that the ores have been subjected to burning long enough, the mine will be flooded from the 100 level to the bottom of the 500. The copper waters which have then passed for months through the workings where burning has been in progress will be pumped to the surface and subjected to precipitating treatment. Mine operators are watching with interest the Copper Belle experiment.

LaRose-O'Brien Litigation Closed

The long-standing litigation between the LaRose and O'Brien Mines of Cobalt has been settled out of court by a payment understood to amount to $125,000. The case arose over the question of the boundary line between the two properties.

News From Washington

By PAUL WOOTON
Special Correspondent

Transfer of Bureau of Mines Gives Opportunities for Economic Studies

Benefit Derived by Similar Work for Agriculture Can Be Extended to Mining Industry—Survey Reorganizes Leasing Division

Transfer of the Bureau of Mines to the Department of Commerce and the detailed study of its functions being made by a committee representative of industry are regarded very generally as offering a unique opportunity for the performance of a great service to the mining industry. The government has done comparatively little work in the general field of the economics of mining. Mining engineers and mining men generally have a deep-seated conviction that their industry lies at the base of all others. They have given much thought to the exhaustion of mineral resources, for instance, and believe that the subject never has received from the government the attention it deserves.

Taxation of mines and mineral deposits and the effects of import tariffs are examples of questions which can be studied best by an agency other than the industry. These matters never have been pursued by the government for the mining industry in the same understanding way that they have been followed on behalf of agriculture.

Reorganization of some of the bureau's functions and a critical analysis of all of them under the leadership of one of the most eminent mining engineers of the world, who won his reputation on his organizing ability, presents the chance to put the study of the economics of mining on a permanent basis. In accord with Secretary Hoover's thoroughly established policy, this type of work is to go only as far as the industry itself desires. His sympathy with trade associations guarantees that all the work they are capable of performing to best advantage will be reserved for them.

The combination of circumstances and leadership which has made possible the establishment of a permanent study of mining economics has never occurred before and may not occur again in half a dozen administrations to come. With the statistical work taken over from the Geological Survey as the nucleus, broad studies can be undertaken in the economics of marketing, financing, valuation of ore reserves, price control, consolidations of producers, and the promotion of export trade.

The result of such work would be of great practical benefit to those engaged in mining, many believe. In three years Mr. Hoover would be able, it is thought, to make the bureau the center which will offer mining men the help on their business problems that the Bureau of Agricultural Economics extends to the farmer, or the Bureau of Foreign and Domestic Commerce extends to the manufacturer and exporter. The whole idea is to make the Bureau of Mines a well-rounded service organization capable of helping the mining industry in any way it wants to be helped. The subcommittees into which the Reynders advisory committee has divided itself seemed to be very favorably impressed with the character of research work which the bureau has done. It has been found to be fundamental in its character. Thus far no work has been found which likely would have been done by the industry itself. Industrial research in nearly every case has for its object the increase of production or the reduction of costs. It has been developed that there are few conflicts between that of the Bureau of Standards and that of the Bureau of Mines. For the most part the Bureau of Standards strives to ascertain what the consumer has a right to demand. The research of the Bureau of Mines is intended largely to help the producer in meeting those demands.

Geological Survey Abolishes Directorate of Leasing Division

F. B. Tough has resigned as director of the leasing division of the U. S. Geological Survey and the position he has occupied will be abolished. It now is planned to vest the authority heretofore wielded from Washington in the men in the field. The Survey hopes to avoid the weakness often manifest in the administration of government activities and in large commercial organizations where every question that arises must be referred to the main office. The men on the ground are to be given ample authority to deal with most of the situations likely to arise. This is expected to appeal to sincere operators on the public lands who object to doing business with a government office 2,000 miles away.

The resignation of Mr. Tough is regarded by Survey officials as a serious loss to the government service. Responsibility for this loss is laid at the door of the Bureau of Mines. It was that bureau which assigned Mr. Tough to assist in the effort to get the wild helium-bearing gas well at Nocona under control. Mr. Tough so distinguished himself on that occasion that the Humphreys Corporation has seen fit to pay him a much larger salary than he has been receiving in the government service.

Three field divisions under the jurisdiction of district supervisors who are engineers in charge with full authority and responsibility to conduct operations and represent the government will be established. The divisions include the Rocky Mountain district, with headquarters at Casper, Wyo.; the Pacific district, with headquarters at Taft, Calif., located in the heart of the California oil fields; and the Mid-Continent district, with headquarters at Muskogee, Okla.

Centralization of authority in the engineers in charge of these districts resulted from the constant development of operating problems necessitating immediate decision and requiring a high degree of skill in oil-field operations. Up to the time of the reorganization it had been the custom to refer all questions of administration to the Washington headquarters of the Geological Survey before final action was taken. Under the new plans the engineers in charge will act on their initiative and authority.

The engineers placed in charge of the various districts include R. C. Patterson, at Taft, Calif.; J. W. Steele, at Casper, Wyo., and H. J. Lowe, at Muskogee, Okla.

Federal Oil Conservation Board Report Soon

The Federal Oil Conservation Board is making rapid progress in its digest of answers to questionnaires addressed to oil producers, engineers, and others, and the board will probably make a report to the President in November. The digest is featured by an exhaustive discussion concerning the "unnecessary use of oil as fuel," and John Hays Hammond, who served as chairman of the United States Coal Commission, makes this statement:

"It is an economic waste to use oil as boiler fuel in any part of the United States outside, perhaps of California, Oregon, and those portions of the Southwest where long freight hauls make the price of coal excessively high."

Calcined Talc Hard as Quartz

The U. S. Bureau of Mines, at its Columbus experiment station, has obtained encouraging results in experiments with talc. Talc when calcined becomes as hard as quartz and has very fine di-electric qualities. The commercial practice in the making of electric heaters has been to carve the necessary models out of soft talc. Before the burning can be completed there is large loss. The Bureau of Mines has demonstrated that the material can be ground up and molded into any form so as to possess a considerable amount of substantiality. The product then can be calcined with little breakage. The process also allows the use of material of much lower grade.

Cuyuna Manganese Mines Operating at Capacity

The manganese mines of the Cuyuna range, Minn., are enjoying a run of prosperity, as all but two have operated the present season. A still larger demand is expected, as the Clement K. Quinn Co., of Duluth, is preparing to strip the Sultana Hopkins properties of 120 acres at Ironton, Minn. The overburden amounts to 1,500,000 yd. and averages 52 ft. thick. Work will start soon with one shovel and a drag line and continue into the winter.

Eagle-Picher Co. Completes Test Drilling in Custer Co., Colo.

The Eagle-Picher Lead Co. has completed its drilling campaign in Custer County, the objective having been the development of unexposed bodies of lead carbonate ore of the nature of the deposit being worked at Ilse, which is confined to the same granite break.

The drilling results prove the economic utility of churn drills in development and prospecting. Approximately 11,000 ft. of ground was penetrated, comprising forty-five holes ranging in depth from 200 to 400 ft., each cutting the break on its dip from wall to wall.

Trout Mining Co. Successful in Mining Manganese Ore

Ore Concentrated in Electromagnetic Plant—Iron Mountain Mining Co. Completes Mill

The Trout Mining Company, Philipsburg, Mont., although operating only a comparatively short time, is making a substantial profit each month from its manganese and silver operations. The company is a Delaware corporation, formed by Lester D. Frink, formerly of the North Butte Mining Co. The company has leased claims from the Philipsburg Mining Co. and is treating "black" manganese ore in an electromagnetic plant, the resultant concentrate being shipped to the Manhattan Electrical Supply Co., which owns practically all of the shares of the Trout company. The manganese is used entirely in the manufacture of dry cells.

The Iron Mountain Mining Co. has nearly completed the installation of machinery at mine and mill, near Superior, Mont., and ore-crushing will be in operation about the middle of the month. Several raises are being run in the mine under the direction of Glenn Anderson, superintendent. Mill construction is being supervised by Raymond E. Tower.

Landslide Closes West Coast Route to Mines in Mexico

With a roar that is reported to have been heard for miles, a landslide swept away a nearly completed tunnel that was being constructed on the new line of the Southern Pacific of Mexico, 20 miles south of Tepic, Nayarit, Mexico. The slide occurred on the night of Sept. 16, when no workmen were on duty, otherwise hundreds probably would have lost their lives.

It is estimated that six million tons of dirt and rock slid down the mountainside, wiping away the tunnel. No estimate has been placed on the loss by the railway officials. Eight hundred workmen have been laid off the construction work until the damage has been estimated.

The new road on which this tunnel was being built will eventually lead from Nogales to Mexico City.

Ajo leaching vats under construction for Inspiration Copper Co. Each of the thirteen vats has a capacity of 7,500 tons

Local Syndicate Plans 250-Ton Flotation Plant for Leadville Ores

A local syndicate headed by Dr. J. H. Miller of Salt Creek, Colo., contemplates the erection of a 250-ton flotation plant to treat complex Leadville ores. The proposed plant will be in California Gulch near the Arkansas Valley smelter. The basis of the milling operations is production from leases secured on several Breece Hill properties, including the Resurrection and Fortune mines, and from custom production. Complex ores are in abundance in the region and the success of the Utah milling plants will cause the flow sheet of the Leadville mill to be of similar design. The lead and iron concentrate will be marketable locally, the zinc concentrate being forwarded to zinc recovery plants.

United Eastern Sinking Shaft; Lincoln-Bluebird Installing Mill; Logan Mine to Be Opened

The Prescott district of Arizona is taking on new life, as evidenced by recent developments. Good progress is reported at the Barbara Mountain property, near Mayer, where the United Eastern Co. has been carrying on a development program during the major part of this year. A shaft has been sunk 348 ft., and crosscutting is being carried on at the rate of seven feet a day on the 100 level. Several mineralized seams have already been tapped in the drift.

A new 20-ton mill is to be installed in the Lincoln-Bluebird mine, in the Crown King district, a small test mill having proved a success. The property was actively worked some years ago, but recently has remained idle. Several good bodies of high-grade ore are reported to have been uncovered in the extension to the old workings. The property is but 4,000 ft. from the railroad, and it is anticipated that when the new mill is in operation satisfactory results will be obtained.

Operations are to be resumed at the Logan mine, in the Cherry district, in the near future. The mine has been closed down pending reorganization.

Negotiations Under Way for Sale of Mammoth and Mohawk Mines

Negotiations are under way by men connected with the Inspiration mines, acting as individuals, to purchase the Mammoth and Mohawk mines, northwest of Tucson, with a view to increasing the development of those properties. The Mammoth was during the war one of the largest producers of molybdenum in Arizona, and has a long record as a gold producer. The increased price of lead and the assurance of approximately $7 per ton gold value from the workings are the basis of negotiations.

Tungsten Ore Discovery in Maine, Reported

A deposit of scheelite has been discovered in the valley of the Androscoggin, within eight miles of Lewiston-Auburn. Claims have been staked off and filed and sufficient backing obtained from Boston and New York financiers to insure development, which it is reported will begin immediately.

W. R. Alexander, a Montana mining and civil engineer, formerly in the employ of the Central Maine Power Co., made the discovery while making surveys for the new power development of that company.

Texas Potash Discovery Reported

The National Potash Co. is preparing to drill a number of test wells near Crowell, Tex., for potash upon acreage which it has leased in Foard and Cottle counties. While drilling for oil in that section, L. C. Harper and T. J. Woodley, who are interested in the National Potash Co., encountered a bed of potash at 800 to 1,000 ft. below the surface. Samples showed a large percentage of potash. It is for the purpose of determining the extent and working possibilities of this deposit that test wells are to be drilled.

Electric Pumps at Calumet to Reduce Lifting Costs

Five of the six electrical vertical triplex pumps to be installed in Tamarack No. 5 shaft of Calumet & Hecla Consolidated, in the Michigan copper district, are in place and the remaining unit will be ready in another month. It will be after the first of the year, however, before the entire project is completed. The new system, which will do away with bailers in Tamarack No. 5 and steam pumps in Calumet No. 5, will effect notable economies in pumping expense, estimated as high as 25 per cent. A power line has been extended to the shaft and a sub-station built, but underground wiring remains to be done. A battery of three pumps will do duty at the 52nd level and three at the 24th. Each pump will lift about 300 gallons per minute, the water being pumped from the bottom of the shaft to the 24th level and from there to surface. Another electric pump at the 10th level will take the place of four steam pumps now handling the water in the upper part of the shaft. In Tamarack No. 1 an electric pump will handle the flow from the 900-ft. level.

Strontium Deposit Reported in Nye County, Nev.

About 50 miles east of Tonopah, Nev., there was discovered recently an enormous outcrop of strontianite. Geologists who have seen samples of the strontium mineral found in Nye County declare it to be of commercial value and a product for which the chemists of the United States have heretofore had to rely upon Europe.

Samples of the mineral have been sent to the U. S. Bureau of Mines in Washington.

Tungsten Claims Near Twin Buttes, Ariz., Basis of New Corporation

B. S. Wilson and a group of Tucson associates have completed negotiations for taking over a group of patented tungsten claims which are located in the Guijas mountains of the Arivaca district 25 miles south of Twin Buttes, Ariz. The property was formerly owned by the National Tungsten company. The new owners are forming a close corporation and expect to be producing tungsten ore on a large scale in the near future.

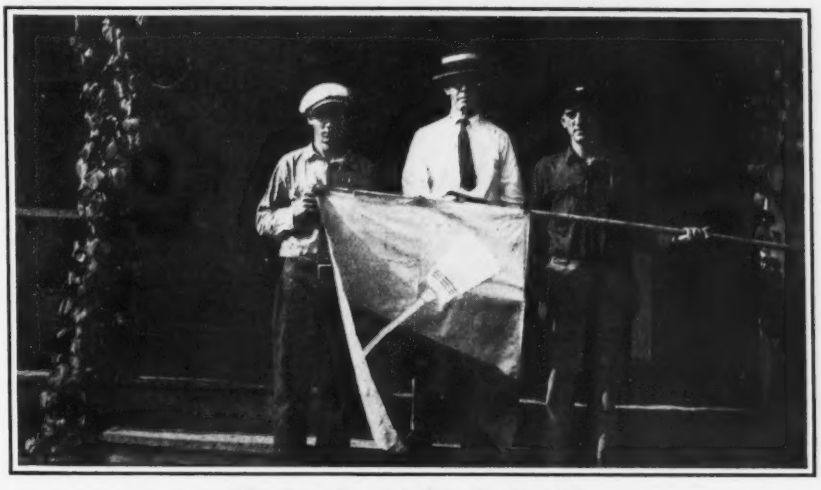
Betty O'Neal Mills 80 Tons Per Day—Pays Dividend

The Betty O'Neal Mines Co., operating near Battle Mountain, Nev., is milling 80 tons of ore per day. An intermediate drift on the 600 level has recently entered some high-grade ore, and samples from a 2-ft. width are reported to assay $1,000 per ton.

Extensive surface improvements, including the installation of two new 300 cu.ft. Chicago Pneumatic air compressors, are being made. N. H. Getchell, general manager and vice-president, has announced that the Betty O'Neal will pay a dividend on Nov. 15.

Accident Prevention Stimulated by "New Broom" Flag

Leadership in the accident-prevention campaign being conducted in the Joplin-Miami district is indicated by a "New Broom" flag, which is hoisted at the property having the largest number of consecutive mining shifts without a lost-time accident. The contest started last July, and the flag first went to the Kanok Mining Co.'s Premier mine, with a record of 3,200 shifts without a lost-time accident. A short time later the Eagle-Picher Co. claimed the flag for its Ellis property, where 3,800 shifts were worked without an accident. The latest winner is the Commerce Mining & Royalty Co.'s Wilbur mine, which had 4,710 shifts without a lost-time accident.



The "new broom" flag, Joplin, Mo.

The flag itself is a simple affair, of two colors, with the outline of a broom upon it. Its possession is being fought for with enthusiasm by the different companies.

Several of the larger companies are encouraging the accident-prevention work by offering bonuses to the foremen of from $20 to $50 for a month without an accident. In some cases the money is paid to the ground foreman and in others it is divided between the ground foreman and the mill foreman.

New Steel Dump Car Operates With Minimum Mechanism

The differential steel dump-car built by the Differential Steel Car Co., of Findley, Ohio, has been tested during the summer at various open pit mines on the Mesabi range and has created a favorable impression. This car has a capacity of 80,000 lb. with volume of 24 yd. level and 36 yd. normal load. It stands at 48 deg. in dumping position and clears the track in good shape when dumping. It is operated by two cylinders on each side and unlike other cars rests directly on the bolsters in loading position, eliminating most of the hinges and trip mechanism found on other cars which keep repair bills so high. Another big advantage is its height, which is 12 in. lower than the present 20-yd. cars.

Copper Range Cons. Production 2,000,000 Lb. Per Month

The heavy flow of water from the overburden into No. 4 shaft of the Champion mine of the Copper Range company, in the Michigan copper district, is being adequately handled by electric pumps on the third level. Auxiliary equipment is available at the sixth level. Operations are normal and the new openings are in splendid ground. Copper Range production now exceeds 2,000,000 lb. of refined copper per month, coming from the Champion and Baltic shafts. Trimountain development work continues and the Trimountain shafts will be a source of profitable production when there is a demand for additional metal. The small tonnage of Trimountain rock stamped indicates a yield of better than 34 lb. per ton, which exceeds that of Baltic by more than 2 lb. Champion's yield is the highest in its history, averaging nearly 44 lb. per ton of rock treated.

Seneca Copper company is building an addition to its compressor house to take care of two additional compressors, which will double the compressor capacity. A concrete reservoir is being constructed at the No. 2 Gratiot shaft to provide a water supply for the boilers. No orders to resume actual mining have yet been received, although it is expected operations will be under way before winter.

Leadville Mines Making Regular Shipments

Leadville is taking on new life. The Deep Mines Co., owned by the American Smelting & Refining Co., is unwatering Carbonate Hill with electric pumps placed in the Green Back mine and is shipping daily to the smelter about four 40-ton cars of lead-silver ore; the Five Star mine, a short distance west of the Green Back mine, is working thirty or more men and shipping two or more 40-ton cars daily of the same character of ore as that of the Green Back mine. Some of the leasers on the Little Johnny are on "easy street." The Canterberry Hill drainage tunnel is driving ahead.

High-Grade Zinc Ore at Delvin Mine, B. C.

The Delvin Zinc property, situated on the north fork of the Kitsault River, 6 miles from Alice Arm, B. C., is being developed by San Francisco interests, which have uncovered three lodes carrying sphalerite in important quantities on the surface. The lodes are 2, 8, and 12 ft. wide, respectively, and samples assay as high as 51 per cent zinc. An adit is being driven on the 12-ft. lode, and as soon as there is a sufficient body of snow to permit sledding shipments of ore will be made to tidewater posts.

Canadian Mines Merger Elects Officers

At the annual meeting of the Canadian Mines Merger, held at Kaslo, B. C. Henry H. Armstead was elected president and Eric Dawson secretary-treasurer. The board consists of the officers and Reginald Dawson, Felix E. Wormser and H. Brown.

Mr. Wormser was appointed general manager and W. H. Burgess of Kaslo auditor. The physical and financial reports were approved and copies will be sent to the shareholders, according to a Kaslo report. The company has several properties, but the chief operation at present is on the Utica mine.

At the second extraordinary meeting the first preferred stockholders canceled their claim of 25 per cent net smelter returns, thus clearing the way for Colonel Armstead to finance the company on the plan he has outlined.

Carson Valley Mining Co., Promoted by Ministers, in Trouble

The State Corporation Commission of California recently cited the officials of the Carson Valley Mining Co. to appear before the commission on Sept. 25 to show cause why the company's license to sell stock should not be revoked. The Carson Valley Mining Co. was organized on May 24, 1923, and has obtained permits to sell 200,000 shares of stock with a par value of $1 per share. The company has an office in San Jose and was sponsored by the Rev. Hugh W. Gilchrist, formerly president of the company and now said to be a stockholder. The Rev. W. K. Towner is secretary-treasurer of the company.

The specific charge against the company appears to be the issuance of promotion literature before securing the approval of the commission's office, as the law provides. Although many extravagant and bizarre claims were made, the company to date is reported to have produced only $890 in two and one-half years from its alleged mines in Nevada and in Alpine County, Calif., and only recently possessed $5.63 in cash.

Thousands of dollars of stock are said to have been sold to the gullible members of a prominent church in San Jose. The story has the usual earmarks of the confiding public on the one hand, and, on the other, a stock-unloading scheme curiously entwined with the affairs of a church.

Judgment in Case of Iron Cap vs. Arizona Commercial Modified

JUDGMENT of the Gila County Superior Court in the case of the Iron Cap Copper Co. vs. Arizona Commercial Mining Co. was modified somewhat and affirmed as modified in an opinion handed down recently by the Arizona State Supreme Court. The lower court's judgment quieted title of the Iron Cap company to its claims. Arizona Commercial appealed from this judgment, and in January of this year the Supreme Court reversed the judgment, and in its opinion stated that the lower court's decision was too broad and might in the future prevent the Arizona Commercial company from showing that two of its lodes in some manner unknown at the present might continue in their downward projection into the property of the Iron Cap. The latter company then obtained a rehearing and the recent opinion of the Supreme Court is the result of this hearing. The latter opinion, in place of reversing the judgment of the Superior Court, modifies it so that it applies only to those claims now being worked by the Iron Cap.

Monthly Mine Production to Be Obtained by Ontario Department of Mines

The Ontario Department of Mines is endeavoring to obtain from mine owners figures showing the monthly production of all the producing gold mines of northern Ontario, and with this object in view Deputy Minister Thomas W. Gibson has sent out circulars asking all mine owners to co-operate in securing this information monthly. The possible objection of smaller producers to making their monthly figures public is met by the suggestion that where such objections arise the department will lump the output of the smaller producers. It is desired to secure this information by the fifteenth of the following month.

Argonaut Co. Reorganizes

The Argonaut Co., operating in the Larder Lake section, Ont., has decided to form a new company called the Argonaut Consolidated Mines, Ltd., with a capital of $3,500,000. The present shareholders will receive one share of new stock for every two now held, and it is believed that this scaling down of the capital will be beneficial to the shareholders and will provide sufficient treasury stock for any new capital that may be needed. Production on the property is stated to be satisfactory and during the past six months smelter returns from copper alone have amounted to $54,000. The average gold content of the ore for the six months period was $8.94, but during the past three months mill heads are running approximately $10 in gold, in addition to the copper.

Godiva Mine Under New Management

Control of the Godiva mine, at Eureka, Utah, has passed to Jackson McChrystal. It is understood that the United States Smelting, Refining & Mining Co. will join Mr. McChrystal in the development of this property. The Godiva mine has a shaft to the 1,200 level and a winze on the 1,200 to the 1,350 level. On both the 750 and 900 levels are good ore showings. Past production has come from the upper limestone. The lower limestone belonging to the Eagle and Blue Bell series are to be exploited in the future. From these strata most of the recent production of Tintic has come. Operations were resumed on Oct. 1.

Twenty-fifth Anniversary of Mond Nickel Works

The twenty-fifth anniversary of the foundation of the Mond Nickel Works, at Clydach, Swansea Valley, Wales, has just been celebrated. Sir Alfred Mond, chairman of the company, spoke interestingly of the scientific discovery that laid the foundation of the works, and said the success and development of industrial enterprise was truly a social service to the community. Nickel is one of the hand-maidens of modern metallurgical practice, and the combination of steel, chrome, and other metals has developed a series of new metals that will revolutionize engineering practice, by providing alloys of great strength, capable of withstanding high temperatures and much less subject to corrosion.

Waite Property to Be Prospected by Diamond Drill

Encouraging results have attended preliminary work on the Waite property, comprising about forty claims situated on the line between Duprat and Dufresnoy townships in northwestern Quebec. Surface trenching and test-pitting have shown that the orebodies extend for a considerable distance on the surface. Average assays to date show copper, silver, zinc and gold. The average value is conservatively estimated at $40 per ton. During the winter diamond drilling will be undertaken to prove up the deposits at depth.

Canadian-Lorrain Mine Opens New Oreshoots Containing Native Silver

It is officially stated that at the Canadian-Lorrain, in the South Lorrain area of northern Ontario, No. 10 vein at the 350 level shows a new oreshoot 20 ft. long carrying 47 oz. of silver over 14 in. Another new oreshoot beginning at vein No. 10 and continuing to No. 17 to the present face is 61 ft. long, averaging 470 oz. over a width of 8 in. for 38 ft., and 5,250 oz. over 4½ in. for 23 ft. The face of oreshoot "E" on No. 177 vein has not yet been assayed, but carries approximately 5,000 oz. silver to the ton over 3 in., and the wall rock contains ruby and plate silver the full width of the drift.

London Letter

By W. A. Doman
Special Correspondent

Labor Shortage Source of Anxiety at Brazilian Mines

Coffee and Rubber Plantations Recruit Workers—No Sale for Arsenic—Tin and Lead Market Good

London, Sept. 22—Considerable interest has been evinced in the statement contained in *Mining Journal-Press* of Sept. 12, 1925, concerning labor conditions in Brazil. The report has been a fruitful topic of conversation among technical men and on the Stock Exchange. The opinion appears to be that the local government is not doing justice either to itself or to the mines. It is even rumored that the St. John del Rey management is considering shutting down. One engineer has said that a mining company in Brazil was willing to pay exceptionally high wages for native labor, but that owing to the revival in the rubber-growing industry, to the expansion of coffee growing, and to the growth of the textile industry it was not possible to obtain recruits. Colonel Yuill, of Bainbridge, Seymour & Co., returned from Brazil a few days ago, and he confirms the statements. He has been in the country since February in connection with the South American Gold Areas property at Sao Bento, the technical management of which is in the hands of his firm. He seems disappointed at the position of affairs, as it was not possible to continue development work. The machinery and plant of the Gold Areas are in good condition, but owing to lack of labor the company can work only at about 25 per cent of capacity, and there is an insufficiency of good ore developed. In addition, the arsenic upon which calculations were based is unsalable, though the price when the new financing was consummated was about £68 per ton. The question now is as to whether the mine should be kept open until conditions improve or should be closed down and the remaining funds utilized for other purposes.

Another Brazilian mine in the Goyaz district is to undergo a further investigation unless the news contained in *Mining Journal-Press* should check the start of the engineer.

As usually happens when one market in the Stock Exchange has had a good run, the public looks around to see which is the next to be taken in hand. After rubber it is predicted that base metals will come to the front. Tin is spoken of as having the first chance, and Nigerian shares already show some activity. The companies at present are doing well, as also are some of the Malayan mines. The price of the metal is over £260 a ton, and the position is said to be satisfactory. After tin, lead seems to be booked for a rise. The present quotation is about £40 a ton, and a shortage here is talked of. Owing to the shipping strike, some heavy consignments, about 10,000 or 12,000 tons, of a value of about £500,000, are held up in Australia. Unless the position be soon ameliorated a price of £45 a ton is predicted.

Referring to the Ranga Tin Syndicate, in the South West Protectorate, it is reported that some mining areas which Trewartha James turned down as not likely to prove profitable under present conditions are to be floated in London by a syndicate at the head of which is a member of the Stock Exchange. It would be unfortunate if the first flotation from this district should prove a failure.

H. F. Denny is expected to proceed soon to Southern Angola on important mining business. He will be absent about three months.

Magnesite Deposits and Production in Venezuela

Properties Owned by Americans—Operated as Quarries—High-Grade Mineral

The magnesite deposits of Venezuela are on the Island of Margarita, which lies north of the mainland, about 200 miles from the port of La Guaira. Because of litigation, there has been no production since 1921, but since the legal questions have been settled operations will probably be resumed soon on the principal deposits, which are owned and worked by American interests. It is their intention to have a monthly output of 1,500 long tons of pure crude magnesite.

No concessions have ever been given by the government of Venezuela to work or calcine magnesite, as under the national law the workings are quarries, not mines, and no concessions are needed.

The two principal magnesite deposits on the island are La Loma de Querra and La Constanza, both under lease to an American company, the former until 1937 and the latter until 1935. The La Constanza property is generally considered to be not very valuable, as the deposits appear to be small and to contain much silica. This opinion is disputed, however, and the statement has been made that 100,000 tons of magnesite are in sight on this property. So far, not much magnesite appears to have been quarried here, all work having been stopped in November, 1916.

The La Loma property contains more than 200 acres, but the actual deposits do not appear to cover nearly all that territory. It is favorably situated for exploitation on a large scale at low cost, covering a series of hills which development indicates are composed largely of a magnesite formation. It is reported that there is a large tonnage of magnesite in sight, and that the veins are larger and better as greater depths are reached. The magnesite is found in decomposed serpentine rock, which is abundant in the foothills and flanks of the higher mountains.

This deposit has been opened by four quarries cut into the hillsides at different elevations. During the early mining, the output from the operation here was handled by an inclined railway, which took the material down to the level of La Loma station by gravity. From there it was shipped by rail to a terminal deposit or stockpile in Manzanillo.

Surface Plant Aztec Mine Destroyed by Fire

FIRE of unknown origin on Sept. 25, destroyed much of the shaft timbering of the Aztec mine at Oatman, Ariz., and the entire surface plant, consisting of hoist house, change room, and headframe. Damages are estimated at $50,000. The buildings and machinery are covered by a blanket insurance policy for $13,000. The fire came just at a time when the mine was entering a period of prosperity and increased activity. The leasers, especially Shanks and Schmidt, have been producing ore steadily and the monthly clean-ups have been in the neighborhood of $50,000. A connection has been made with the transmission line of the Desert Power & Water Co., of Kingman, and preparations had all been made to operate the surface by electric power. Unless the Aztec shaft is retimbered about 300 ft. the ore from the mine will have to be hoisted through the shaft of the United American property, the workings of which are connected with those of the Aztec.

Magnesite veins extend up to the surface of the ground, so there is little waste material to remove by quarrying. Before suspension of work, it was reported that a minimum output of 1,000 tons monthly could be easily reached at La Loma, and that this could be soon increased to 2,000 tons or more.

All the magnesite produced so far has been exported, as there is no domestic market. Official export statistics begin with the second half of 1913, when 2,000 tons was exported; 300 tons was exported in 1914, 5,300 in 1915, 6,360 in 1916, 1,700 in 1917, none in 1918 or 1919, 2,000 in 1920, and 2,400 in 1921. All these shipments were to the United States except those for 1920, which went to Great Britain.

The magnesite is white, uncrystalline, and dense in texture, and quite free from impurities. It is said to be especially suitable for all uses in which quality is essential. Chemically pure magnesite as found in nature contains 47.5 per cent of magnesium oxide and 52.5 per cent of carbon dioxide gas. Analyses of cargoes of 1,000 tons or more shipped give about 55 per cent magnesium carbonate and about 3 per cent of silica, but it is stated that some lots shipped to the United States have given as high as 45.72 per cent of magnesium oxide, which makes it 96 per cent pure.

Transportation is easy and not expensive, the deposits being not far from a good harbor on the north coast of the island. The company owns a railway line from the quarries to the port, capable of handling a monthly tonnage of 2,000 tons. The port offers a sheltered harbor where large steamers can anchor with safety close to shore and load in all seasons.

The operating company contemplates erecting a calcining plant on the island.

Men You Should Know About

Harry D. Griffiths will go to Burma in the near future, and expects to be absent five or six months.

H. T. Leslie, formerly of the Dome Mines staff, has been appointed manager of the Goudreau Gold Mines.

W. de L. Benedict, consulting mining engineer, has returned to New York from California, after an absence of two months.

C. D. Richards, of Frederickton, N. B., has been appointed Minister of Lands and Mines in the new administration of New Brunswick.

J. B. Tyrrell, of Toronto, managing director of the Kirkland Lake gold mine, is leaving shortly for a visit to London, England.

R. V. Hennen, chief geologist of the Transcontinental Oil Co., has returned to headquarters at Pittsburgh from a field trip to California and Texas.

W. Val De Camp, mine superintendent for the United Verde Copper Co. of Jerome, Ariz., was a recent visitor in the Globe-Miami district.

Owen F. Brinton recently resigned as manager of the Jib Consolidated Mining Co. of Basin, Mont., and has been succeeded by August Grunert, formerly mill superintendent.

Charles T. Lupton, consulting geologist of Denver, Colo., made a business trip to Houston, Tex., in September. Mr. Lupton is the discoverer of the Cat Creek, Montana, oil field.

P. G. Beckett, general manager of the Phelps Dodge Corporation, was recently in the Globe-Miami district for the purpose of inspecting the properties in which the corporation is interested.

W. R. Feldtmann, who has severed his connection with the Ashanti Goldfields, has been appointed general manager of the South West Africa Co., and will proceed to the property early in October.

William P. Stein, for many years chemist in the research department of the Timber Butte Milling Co. (W. A. Clark interests), has been appointed chief chemist of the DuVal, Moore Co. plant at Berkeley, Calif.

F. O. D. Bourke, general manager of the Naraguta (Nigeria) Tin Mines, has returned to London from a visit to the property, and it is understood that the Korot areas of the company are to be transferred to a subsidiary undertaking.

James W. Wade, assistant manager for the Tintic Standard Mining Co., has been named as a regent of the University of Utah by Governor George Dern. The Utah School of Mines, of which Mr. Wade is a graduate, is a part of the university.

Alexander Gillies, a well-known prospector, who has returned from the Red Lake area in the Patricia district of Ontario, states that while the showings are interesting, there will not be much activity in that field before next summer. The distance of 140 miles by the winter trail will, he thinks, deter prospectors.

L. L. Bolton, according to an announcement made on Sept. 8 by Charles Stewart, Minister of Mines for Ontario, has been promoted by the Ontario Civil Service Commission to the position of Assistant Deputy Minister. Mr. Bolton, who is an honor graduate in science of Queens University, Kingston, entered the department in 1915. Prior to that he served on geological parties for the Ontario Bureau of Mines and the Geological Survey of Canada, and for seven years was

L. L. Bolton

geologist of the mining department of the Lake Superior Corporation, Sault Ste. Marie, Ontario. On entering the Mines Department he was first on the staff of the Division of Mineral Resources and Statistics of the Mines Branch; from there he was transferred in 1916 to the position of private secretary to R. G. McConnell, then Deputy Minister of Mines. As the work of the department expanded, Mr. Bolton's duties increased, with the result that he was designated as secretary for the department from 1919. Mr. Bolton's present promotion is the result of the service he has for several years rendered in the conduct of the work of the department.

Archibald Wheeler has been engaged by Noranda Mines, Ltd., to design a smelter for the treatment of ore from the Home mine in Rouyn township, northwestern Quebec. Mr. Wheeler was formerly in charge of the Great Falls plant of the Anaconda Copper Co. and has also had experience in the Belgian Congo. He is now in Rouyn looking over the ground.

Dr. Edward Sampson, associate geologist, U. S. Geological Survey, has been appointed assistant professor of geology at Princeton University. Dr. Sampson received the degree of Doctor of Science at Princeton in 1920, since which time he has been on the staff of the Geological Survey, working on the geology of mineral deposits and acting as a specialist on asbestos, talc, soapstone, and chromite.

Major L. T. Burwash, formerly an official of the Canadian Department of the Interior in the Yukon Territory, is exploring the northern coasts of the dominion to discover their natural resources. The first part of the trip from Aklavik to Coronation Gulf was made by boat, and the remainder of the journey eastward will be made by Major Burwash on foot by way of Queen Mab Gulf and the Gulf of Boothia to Chesterfield Inlet in the northwestern coast line of Hudson Bay, where he will await the arrival of a Hudson Bay Company steamer.

Obituary

John J. Vandemoer, for many years representative of the *Engineering and Mining Journal* at Denver, Colo., died there on Sept. 24, at the age of seventy-six. He was a Hollander by birth, having been born at Amsterdam. At the age of twenty he came to New York, where he found employment on the staff of the Brooklyn *Eagle.* In 1876 he moved to Denver. As early as 1900 he became agent for the *Engineering and Mining Journal,* retaining the connection, with characteristically enthusiastic and efficient service, until 1910, when he joined the Babson organization. Mr. Vandemoer was well known to, and much esteemed by, the mining fraternity of Colorado, and his passing will arouse many sincere regrets, and many happy memories, among his old friends.

Dr. John P. Reins, pioneer mining man of Montana, died in Butte on Sept. 27 at the age of 83. He was born in Virginia in 1842, was graduated from Hillville Academy, and at the age of 19 joined Company H, Twenty-fourth Virginia Infantry, which was almost wholly made up of students of Hillville. He saw service in many of the important battles of the Civil War, both in the infantry and in the Eighth Cavalry, being wounded in a skirmish at Clinch River. He studied medicine for a year, but was forced to give that up owing to the loss of the sight of his right eye, and in 1867 he moved to a farm in Kansas. Being a disciple of Jason, he soon joined the ox-team trains crossing the plains and mountains to Deer Lodge, Mont., engaging in stock raising and in mining and prospecting at Philipsburg until 1875, when he took up his residence in Butte. He took a prominent part in the development of that camp not only from a mining standpoint but from a civil standpoint as well, being prominent in Butte affairs until recent years. He organized the Reins Copper Co., which carried on extensive operations in the Meaderville section, close to the workings of the Leonard mine of the Anaconda Copper Mining Co. A few years ago Anaconda took over the Reins property. Only a few weeks ago Dr. Reins and associates sold controlling interest of the Robert E. Lee Mining Co. to the Butte-West Side Mines Co. He was married in 1884 to Mrs. Mary E. Rumann, of Missouri, and is survived by a daughter, Mrs. Mabel Medin, and a stepson, Reins Rumann.

Societies, Addresses, and Reports

Discuss Mine Safety Problems at National Council Meeting

Bigger Job Than Red Cross, Says J. Barton Payne—B. C. Yates, of Homestake, New Chairman of Mine Section —Meeting at Cleveland

A bigger job than even that of the Red Cross is the work the National Safety Council is performing, is the judgment of John Barton Payne, chairman of the central committee of the American Red Cross, as expressed at one of the meetings of the Fourteenth Annual Congress of the National Safety Council which was held in four of Cleveland's large hotels Sept. 28 to Oct. 2. This congress was the largest the Council has ever held. Rear Admiral Sims, who spoke in the afternoon of Sept. 28, urged that the need in safety was not so much for intelligence as for rightly directed habit. In times of crisis and in excitement, the intelligent man is not as reliable as one whose actions are subconsciously guided in the right direction.

R. Dawson Hall Presides

The meetings of the mining section, presided over by R. Dawson Hall, the chairman, were marked by good papers and considerable discussion. F. C. Gregory, resident engineer, U. S. Bureau of Mines, Duluth, Minn., said that every man engaged by the Copper Queen Consolidated Co. was compelled at the time of his hiring to perform every mining operation under supervision once and was required to do the work according to the "Copper Queen methods," which were explained to him carefully. As a result the company believes it has greatly reduced its accidents while increasing the effectiveness of operation.

In a paper by Mr. Ageton, safety engineer, Tri-State Lead and Zinc Ore Producers' Association, an attack was made on the use of "fear psychology," which he believed only increased accidents rather than prevented them. He advocated posters that were positive, not negative, that told what should be done rather than demanded that certain things should *not* be done. He deplored posters that were gruesome and said that some men were filled by such exhibits with a spirit of bravado, some were imbued with a feeling of resentment and with antagonism toward accident prevention work. Francis Feehan, U. S. Bureau of Mines, declared that emphasis should be put on the importance of life as an asset and declared that where fear psychology posters and methods were adopted the cautious were driven out of the mines, leaving those who were chance takers, rule breakers and men of the "smart Aleck" type.

R. L. Kantz, of the plant-service division of the U. S. Gypsum Co., declared that good advertising men were disposed to veto the gruesome as in its very nature not calculated to aid in the sale of any commodity. Was it not also an inefficacious way of selling an idea? Why not in poster work follow sound advertising practice?

Insistence by Mr. Feehan on the power of the principal executive to get safety "by direction," as he termed it, brought quite a few to their feet, not to deny the possibility of some greater progress by a firmer attitude toward safety where the sentiment was weak or compromising but to affirm that it was not always well to discharge men who failed in some way to comply with instructions or to dispense with a mine foreman because, by some unfortunate circumstance, a life or even more than one life was lost in his mine. B. C. Yates, general superintendent of the Homestake Mining Co., Lead, S. D., and J. L. Boardman, chairman of the bureau of safety, Anaconda Copper Mining Co., declared that the officials at their mines never hesitated despite the shortage of labor to discharge those who wilfully violated safety orders, but when men were scarce, as they now are, the shift bosses manage to overlook their duty to rid the mines of such men by discharge.

Advocates Safety by "Direction"

Mr. Feehan denied, however, that anything more than the threat of discharge and the intention of making good on that threat were necessary to get complete compliance with the rules. When everyone learned that the boss meant business, the rules would be obeyed. T. T. Read, of the U. S. Bureau of Mines, declared that the time was coming when the mine operators would realize that they could not get men by going out and picking them up haphazard. The good man, the man who is a profitable employee, is one for the services of whom the operator should bid by offering attractive conditions, especially as to safety.

The conduct and value of mine rescue stations was the subject of a paper by K. T. Sparks, safety engineer, Central Mine Rescue Station, Wallace, Idaho. Mr. Read briefed this paper for the benefit of the mining section. Mr. Sparks held that an individual station, even if properly equipped, was likely to be inefficient, the management being likely to let the training work lapse and the apparatus deteriorate "especially after a mine has operated for a period of years without an underground fire or disaster of any kind." The author in his paper narrated that at a certain metal mine an underground fire occurred. No rescue equipment had been provided. After that experience the company bought at the expense of several thousand dollars a large number of breathing apparatus, regenerating cans, pumps, and other supplies. By the time a second fire broke out, the machines had deteriorated so badly that they were practically useless. That was natural, seeing that they had not even been removed from the original boxes in which they had been shipped from the factory. No trained men were available and before anything could be done men had to be trained in the use of breathing apparatus.

How Near Should the Central Station Be?

Mr. Read in his brief questioned whether in every case Mr. Sparks could be sustained in his declaration that "the maximum distance from the central station to the most distant mine of the group should not exceed 25 miles." That was a matter depending on the roads and the severity of the winter, according to Mr. Read.

Another matter Mr. Read questioned was the decision of the Coeur d'Alene mine operators to lodge their apparatus and supplies in a railroad coach instead of a building, even though all the mines were approachable by railroad. He believed the erection of a station would possibly have been preferable.

Every large mine, however, has a rescue station at the mine under the general supervision of the central station, all these having from five to fifteen sets of oxygen breathing apparatus. About eighty sets are available should occasion demand the assembling of all the apparatus in the district. The mines contribute 5c. per ton of ore mined to the maintenance of the station. The equipment as it now stands cost $35,000, including the stations at the mines.

The safety practices of the Cleveland-Cliffs Co. were then described by William Conibear, safety engineer of that company, and in the afternoon a round-table discussion of the work of the section was held under the chairmanship of Mr. Yates.

Mr. Conibear stated that his company intended to have the committees examine all accidents, whether trivial, serious or fatal. In many cases the triviality of an accident was due merely to chance; the accident had all the possibilities of being fatal and failed of that end only by a hair.

Women's Committee Helps

B. C. Yates, general superintendent of the Homestake Mining Co., said his company had a central committee of heads of departments and the safety engineer. It also had women's committees; the men were not disposed to make suggestions, but progress was being made in overcoming this reticence. There was some trouble with the abusive language of shift bosses, and some had been discharged for using bad language in addressing miners. Nothing that they said was any worse than one miner would use to another without offense, but coming from a man in authority it was extremely offensive to the men to whom it was addressed.

A. A. Bowden, safety engineer of Pickands Mather & Co., objected to miners being allowed to close fire doors

in case of a fire. He believed that as each mine has its characteristics, the work of closing doors should be left to certain authorized persons.

Mr. Conibear said the main shaft was fireproof and a down-cast, and by closing the doors leading to that shaft the possibility that fumes would get to that shaft was eliminated. Red lights showed when the door was closed so that no trip or locomotive would run into it. It was too late to wait for the door to be closed by an authorized person. The heat in the shaft might have reversed the current.

Mr. Ageton described the Kangaroo court at the lead and zinc mines near Joplin. Each man is termed an accident prevention engineer. One miner is called the prosecuting attorney and another the judge. Those who were convicted were fined and paddled. There is some horseplay about it but not much and it goes hard with even a general manager if he violates the rules of the court, as happened once when he signaled the engineer to raise the can (on which the men ride up the shaft) above the collar of the shaft contrary to orders.

Officers Elected

The following officials for the mining section were elected: B. C. Yates, general superintendent, Homestake Mining Co., Lead, S. D., chairman; B. F. Tillson, assistant superintendent, New Jersey Zinc Co., Franklin Furnace, N. J., first vice-chairman; C. A. McDowell, Davis Coal & Coke Co., Thomas, W. Va., second vice-chairman; Robert E. Talley, general manager, United Verde Copper Co., Jerome, Ariz., third vice-chairman; A. W. Dickinson, general superintendent, Union Pacific Coal Co., Rock Springs, Wyo., fourth vice-chairman; T. T. Read, safety service director, U. S. Bureau of Mines, Washington, D. C., secretary.

"Power Show" Scheduled for Week of Nov. 30

All of the first two floors of the Grand Central Palace and 90 per cent of the space on the third floor have been contracted for by exhibitors at the Fourth National Exposition of Power and Mechanical Engineering to be held from Nov. 30 through Dec. 5, 1925.

One of the features of the show will be a series of lectures on the important developments in power and mechanical equipment during the preceding year. These are planned primarily for students, but will be of general interest to mechanical engineers who wish to bring up to date their information on the rapid development in all phases of mechanical engineering. The list of topics selected for presentation by leading authorities includes: Steam Prime Movers, Oil and Gas Engines, Steam Boilers, Modern Industrial Power Plants, Hydraulic Machinery, Machine Tools, Heating and Ventilating Equipment, Mechanical Refrigeration, Mechanical Power Transmission, Standardization, Material Handling in the Power Plant, Material Handling in Industry, the Steam Locomotive.

Mineral "Diffusion" Discussed Before Columbia Section A.I.M.E.

Novel Theory in Connection With Ore Deposits Presented by F. B. Laney —Sullivan Talks on Smelting Practice

A meeting of the Columbia section, American Institute of Mining and Metallurgical Engineers, was held in the dining room of the Tiger Hotel at Burke, in the Coeur d'Alene district, Idaho, on Friday evening, Sept. 25. The attendance was large, more than 100 being served at the dinner which preceded the program. The meeting was made notable by the presence of Dr. H. Foster Bain, secretary of the Institute, who addressed the meeting. His remarks were confined to Institute affairs, in general terms giving figures showing the income and expenditures of the organization. He emphasized the service rendered by the Institute to members, the value of which he regarded far in excess of their contributions to its support. Regarding the magazine published by the Institute, *Mining and Metallurgy*, Dr. Bain said that it is self-supporting and that he did not regard it likely that it would ever become a source of profit.

Dr. F. B. Laney, head of the department of geology of the School of Mines, University of Idaho, spoke on "Diffusion in Relation to Ore Deposition." He illustrated a theory of mineral diffusion by samples of rock showing alternating bands of iron oxide frequently found in proximity to orebodies, and exhibited glass tubes showing how he had produced the same results in the laboratory. Dr. Laney's theory of diffusion was new and he was congratulated by Dr. Bain, who requested him to submit it in manuscript for publication as a bulletin by the Institute.

M. H. Sullivan, superintendent of the Bunker Hill smelter at Kellogg, described the process of smelting and refining lead-silver ore. He started with the ore when it arrives at the smelter and briefly described each step until the lead and silver emerged from the refinery for shipment.

J. Fred Johnson, mining engineer, who has charge of concreting the shaft at the Morning mine for the Federal Mining & Smelting Co., described the work in interesting detail. The concrete lining is being carried down from the 2,650 level. The space around the shaft back to the rock walls is being filled with concrete to prevent sloughing, caused by the tendency of the rock to slack when exposed to the air.

Visiting engineers devoted the afternoon preceding the meeting to inspection of the Hecla and Star mines at Burke and the Morning mill and mine at Mullan. Saturday, the 26th, the engineers went to Kellogg and devoted most of the day to visiting the Bunker Hill smelter.

Following are the officers of Columbia section: Rowland King, of Spokane, chairman; Harry W. Marsh, of Wallace, vice-chairman; Fred W. Callaway, of Kellogg, past chairman; L. K. Armstrong, of Spokane, secretary and treasurer.

American Mining Congress Plans November Meeting in Arizona

The annual western meeting of the American Mining Congress is to be held at Phœnix, Ariz., Nov. 16 to 19. The details of the convention are being arranged by Secretary J. F. Callbreath and E. C. Porter, convention manager of the organization, of Washington, D. C.; Robert E. Talley, governor of the Western Division, and W. B. Gohring, secretary of the Arizona chapter of the organization of Arizona.

The convention sessions will be held daily at the San Marcos Hotel, at Chandler, 20 miles from Phœnix. Special trips will be arranged for the delegates through the Salt River Valley and over the Apache Trail to Globe, which is one of the scenic drives of the country. Mining men of Globe will tender the delegates a banquet on Nov. 18. The following day the delegates will visit the mining plants, mills, and smelters around Globe and Miami. The tours of the mining men over the Apache Trail and to Globe will be sponsored by the Arizona chapter of the American Mining Congress. The tours will be through one of the important irrigation districts, and the operations of these works, which supply power to several of the large mines, will be explained.

Important problems affecting Western metal mining will be considered at the convention. The tentative program includes discussions of the following: Work of the U. S. Bureau of Mines, position of silver and activities of the American Silver Producers Association, federal valuation and taxation of mines, railroad freight rates, industrial relations, standardization, and mine safety.

Northwest Mining Association Hears About Alti Zinc Mines

The Northwest Mining Association held its first fall session Sept. 24 and voted to hold the annual Northwest mining convention in Spokane during the week beginning Nov. 16.

S. Grossbard, of Waller & Grossbard, consulting engineers, 14 West 45th St., New York, addressed the association and said that the price of zinc, in his opinion, will not be materially lower until the product from the Alti mines of Russia enters the world market, and that this is not likely to occur for four or five years. He has recently made a personal investigation of the Russian zinc supplies and mines. Potential production there seems to be as important as that in any part of the world, though present output is not large.

"It will require $2,000,000 to $3,000,000 to develop these zinc properties and considerable time," said Mr. Grossbard. "The mines are so far from market it will not be practical to ship the product except in its refined state, and this will require more money and time for the construction of refineries."

Mr. Grossbard is in the Northwest contracting for zinc ores for the Lemoine-Bies et Harang of Paris. He says the Alti ores run about 22 per cent zinc, 20 per cent lead, and 40 oz. in silver.

Refutes Notion of Copper Famine

J. R. Finlay Sees Adequate Supply "for as Long a Time as Is Worth Thinking About"

In "Foreign Affairs" for October, J. R. Finlay, well known to everyone in the mining industry, discusses in a "popular" style the outlook for copper. The following are extracts from his excellent essay:

Persons engaged in mining feel themselves prodded from time to time to defend themselves against a common half-truth—namely, that their business is so risky as to appeal only to gamblers and that therefore it is not quite respectable. The retort (it becomes impatient if one is asked to repeat it too often) is that there are only two fundamental industries—first, that which obtains supplies from the vegetable and animal kingdoms, i.e., agriculture, hunting and fishing; second, that which obtains supplies from the crust of the earth, i.e., mining. The first began with the pursuit of food; the second with the pursuit of tools.

Mining Second Oldest Industry

Mining is younger than the pursuit of food, for all animals must have food, and all except man are without tools; but it is older than agriculture and goes back to the time when man first began to look for something that would help him to fight, or to catch, other animals—the time when he became intelligent enough to be called a man. The industrial centers of the old stone age were places where flints could be mined; and it was done on a large scale before even the dog was domesticated, when the wild horse and the mammoth were chased for food by men on foot, when the front of the Scandinavian glacier flowed to the heart of England.

Jumping from the dawn of human industry to its latest stage, we find that mining in the last century has made the greatest strides in its history. The use of the metal copper will show this as well as anything. In the decade ending with 1820 the world production of copper was 96,000 tons; in the decade ending with 1920 it was 10,883,000 tons, or 112 times greater than it had been a hundred years before.[1] In the same century the population of the world has increased by two or perhaps two and one-half times; the use of copper has exceeded it some fifty times over; and it has gained in some such proportion over the pursuit of food. It has not gained so much over agriculture in general, because, outside of food, that industry supplies enormous quantities of products which go into modern manufactures in the same manner and probably in the same increase as the metals—for example, timber, rubber, and cotton. But, for all that, the growth of mining over agriculture has been very great.

It is doubtful if the thinking public realizes the fact that the growth of mining and the dependence of civilization on its products marks the greatest event and the greatest change in human life and human work that ever occurred.

Copper was one of the first metals, perhaps the very first, to be used for tools and so to help in the production of other things. Its use probably began about four thousand years ago. There was the age of copper and of bronze which, if anything, preceded in ancient civilized countries the general use of iron. Yet as much copper has been produced since 1909 as in the preceding four thousand years. We speak of the present time as the age of iron, but the use of copper is growing faster than that of iron. In 1850, one pound of copper was made to 125 pounds of iron; in 1910, one pound to 72; in 1924, one pound to about 50.

But for the last seven years American producers of copper, and presumably those of the rest of the world, have been complaining of hard times: people have not been buying copper as fast as they could produce it. I have not set out here to discuss the commercial side of copper mining, but the fact seems worth mentioning just to show how a commodity can be overproduced on a large scale, in face of a powerful demand, as easily as when the output was very much smaller. And it will serve our end, that of giving a fair survey of the place in the industry in the world, to follow this matter up to see how it came about.

Sequence of the War

Patently, the glut of copper was a result, or at least a sequence, of the war, for it came on with the armistice and has continued ever since—that is, seven years. The depression or confusion caused by it was at its worst in 1922, when nearly all the American mines were closed down. Since then, the output in this country has been raised fourfold; no important mines are closed—in fact, nearly all are running at speed—and yet the market is no longer over-supplied. It can still be easily supplied and there is nothing as yet to force buyers to bid up the price, but we may see that the cycle of over-production has about swung through. Copper all this time has been, still is, and may long continue to be, cheaper by any fair standard than it was before the war; it probably is cheaper than ever before in its history. This fact has come as a surprise to the copper miners. . . .

Commercial efforts are seldom if ever made in answer to a comprehensive survey of the world's needs. The primary cause is the sight of profits. During the whole time we are talking about, say for fifteen years before the war, it was a commonplace that copper mines were more gainful than any others. Promoters had a steady stream of kingly fortunes to point to in the ownership of mines like Calumet & Hecla, Rio Tinto (Spain), Copper Queen (Arizona), Anaconda (Montana), and many others. When other deposits that had long been more or less known were made available by new processes between 1900 and 1910, all the resources of modern mechanical science and of finance were freely spent to develop them to the utmost. The war furnished for a time a channel for the gush of copper that resulted. . . . The principal factors to be considered, I should say, are: first, the growth of methods which make copper cheap; second, the ownership of mines; third, the ultimate supply.

Early Operations in Chile

1. One hundred years ago Chile was one of the chief copper producers of the world. After passing through a decline which brought it to a place of insignificance, it has in late years again become a great producer. By glancing briefly at how they formerly got copper and how they get it now, we shall see how the art has gone forward and why miners are richer than they used to be.

About 1835, Charles Darwin, then on his voyage in the "Beagle," made various notes on the copper mines of Chile. We may quote from him:

"It is now well known that the Chilean method of mining is the cheapest. . . . A few improvements have been introduced in some of the simple machinery; but even to the present day, water is removed from some mines by men carrying it up the shaft in leathern bags! The laboring men work very hard. They have little time allowed for their meals, and during summer and winter they begin when it is light, and leave off at dark. . . . Captain Head has described the wonderful load which the *apires*, truly beasts of burden, carry up from the deepest mines. I confess I thought the account exaggerated: so that I was glad to take an opportunity of weighing one of the loads, which I picked out at hazard. It required considerable exertion on my part, when standing directly over it, to lift it from the ground. The load was considered under weight when found to be 197 lb. The *apire* had carried this up eighty perpendicular yards—part of the way by a steep passage, but the greater part up notched poles, placed in a zigzag line up the shaft. According to a general regulation the *apire* is not allowed to halt for breath except the mine is 600 ft. deep. The average load is considered as rather more than 200 lb. and I have been assured that one of 300 lb. (twenty-two stone and a half) by way of a trial has been brought up from the deepest mine! . . ." My observation of industry leads me to make a remark which may be taken as cruel: those *apires* were well paid with their pound a month and their morsels of dried *charqui*. That method of getting copper would not give them even half as much today; even if they broke their poor backs carrying their heavy loads, if they had only eight figs for breakfast instead of sixteen, they would still fail to make copper cheaply enough; they would be victims not of hard work or oppression, but of the stupidity of trying to match their food against the power of coal, oil, or water, their

[1] Arthur Notman, *Engineering and Mining Journal-Press*, June 30, 1923.

muscles against engines of steel and brass, their skill against the training of armies like those of Standard Oil.

Apire vs. Modern Hoist

Remember the *apire* with his 2,400 lb. a day. I have seen an engine hoisting, by itself, 20,000 tons a day, or 40,000,000 lb.—its attendant wandering about a great room looking at instruments or out of the window. This copper ore came from a depth of 600 ft., in the deserts of North America, where in the time of Darwin copper was mined even more crudely and scantily than in Chile. In the same mines you would find, instead of peons with leather water bags, a little electric pump not much bigger than a bushel basket, with no one to watch it, turned on like a light in your bathroom, pumping a thousand times more water than any army of peons could bail out, and from far greater depths.

It is by such changes that copper has been made cheap and plentiful. During the last twenty years, particularly, the mining of it has been industrialized: it is no longer very much a question of the finding of new and rich veins, but of the manufacture of very large low-grade masses of copper-bearing rock. Many such are known to contain from 50 to as high as 700 million tons, running from 20 lb. to about 45 lb. to the ton in the crude state. And it is not only the application of capital and organization that has brought these great supplies into the market; some improvements in the art of treating the ores have since 1910 made almost every deposit about 25 per cent richer than it was before. . . . With about the same capital and equipment they can either turn out say 25 per cent more copper or they can get the same amount from leaner, more plentiful and cheaper ores: they can make copper cheaper.

Mines Border Pacific Ocean

2. The great source of copper is a strip bordering the Pacific Ocean. There are two active districts in Chile, one in Central Peru, three in Mexico, fourteen in the United States, two in British Columbia, two in Alaska, and two in Japan, to mention only the important ones; and of these the farthest from salt water is only 600 miles, and nearly all are within 200 miles. These mines produce nearly three-quarters of the world's supply today. We might almost call copper mining an ocean shore industry.

Next in present importance, as well as in importance for the future, is the Katanga field in south-central Africa. Next is the Lake Superior field in central North America. Then follow scattering producers like Rio Tinto, in Spain; Mansfeld in Germany, and several mines in the Ural region of Russia. . . .

No Political Problem in Copper

I cannot see any political problem in the production of copper. The share of the Anglo-Saxons in it is quite in line with their share in other metals and industrial products; that is, they control, or make, nearly or quite as much of the iron, lead, gold, cotton, timber, shipping, railroads, factories, etc., as they do of copper. Perhaps this fact is not generally known.

3. The supply of copper is not likely to come to any sudden end. True, if we carry forward the curve of increase as it has progressed in the last century we arrive at an output of about 170,000,000 tons for the year 2025, an amount which it would surely tax the earth's crust to yield. But the very greatness of the figure hints that it is fanciful. If all the peoples of the world should want as much copper as do the white races, the demand would rise to perhaps double what it now is, say to 3,000,000 tons a year. We may imagine, without too much rashness, that it may reach that; but I would not bet on it.

Will Copper Follow Coal and Iron?

A fair guide to what is to be expected in copper production is found in the case of iron and coal, which seem to have passed the peak of increase. Perhaps copper already has also. For two generations the outputs of both coal and iron doubled each decade, but they do so no longer. The peaks of shipments from Lake Superior — 66,000,000 tons—was reached in 1916. Judging by earlier rates of growth, the shipments this year would have been over 100,000,000 tons, but they will not pass 50,000,000. There has been, indeed, some increase in the making of steel, but a small one; and it seems that old metal, scrap, is displacing a lot of iron ore. The same thing may be seen in the output of coal. . . . Thus I think the great upward swing in the curve of copper output is a thing of the past; that it either has already followed, or soon will follow, the course of coal and iron; that the upward swing of demand will neither continue nor be resumed; in short, that from now on the increase of demand will be, by comparison with the past, extremely slow.

It therefore is not too short-sighted to measure the future supply of copper by the amount needed yearly now. There is apparently enough "in sight," that is fully developed or reasonably assured, to last some thirty-five years. . . . We thus come to a supply of some 55,000,000 tons for the world, enough for thirty-six years at the present rate. If that were all the copper to be had from the crust of the earth, one might well fear a shortage in another generation; but that is not the case. As a matter of practice, the reserves are very large; copper miners do not wish to see them added to; it is too patently easy to fill the market. Present explorations carry only a dim idea of the amount of copper to be had ultimately, for several reasons which I shall touch on briefly.

In the first place, there are still large areas in all parts of the world that may contain new copper mines. I have heard of good showings in Siberia; in Africa further finds may be taken for granted; in America there are places where good orebodies may be covered up by younger rocks and may sometime be found.

Secondly, as the total supply of metal increases the amount of scrap increases and the need of new metal from ore becomes less. This fact is seen vividly now in the iron trade; scrap is mentioned much oftener in iron quotations than it used to be. Copper may follow the same course. It is less destructible than iron, more valuable and better cared for. The time may come when the back yards of industry will be all cluttered up with old copper and the need of mining fresh metal may fall off greatly.

No Copper District Worked Out

Thirdly, no copper district in the world, so far as I know, has been worked out. It may have been shut down because it could no longer hold its own with other mines, but it can still produce copper. The great porphyry mines which have more than half of the reserve copper of the world "in sight," run, as said above, from 1 to 3 per cent in copper. Below 1 per cent (20 lb. per ton) they are not commercial, they will not pay. But what of the amount of copper actually there? That is another matter altogether. It is known that vast amounts of leaner ores are to be found, have actually been found, in every field in the world. The total is unknown because nobody, as yet, wishes to measure such stuff; but just to give some inkling of the amount of copper that may be had from such sources, when the world wants it badly enough, I made a rude estimate that a single district in Arizona might furnish (from ores yielding 5 to 10 lb. copper per ton) something like thirty times as much as it has yet given up from commercial ores —indeed, about as much as the total output of the world to date. In Lake Superior a single vein, the Allouez Conglomerate, has never been commercial, but it is 50 miles long and in very large part will doubtless yield 5 to 10 lb. copper per ton—very likely twice as much as the entire past yield of that region. And it is only one of many such veins. It is not unlikely that beds of copper ore such as may one day be payable extend clear under the basin of Lake Superior, for it is said that the very beds that are worked on Keweenaw Point may be seen on Isle Royale 60 miles away, and they have been tried for mining.

Thus, in my judgment, when the world is willing to pay a little more for copper, enough to persuade the miners to work ores running 15, 10, or 5 lb. per ton, instead of 20 lb., it will be able to get all the copper it wants for as long a time as is worth thinking about.

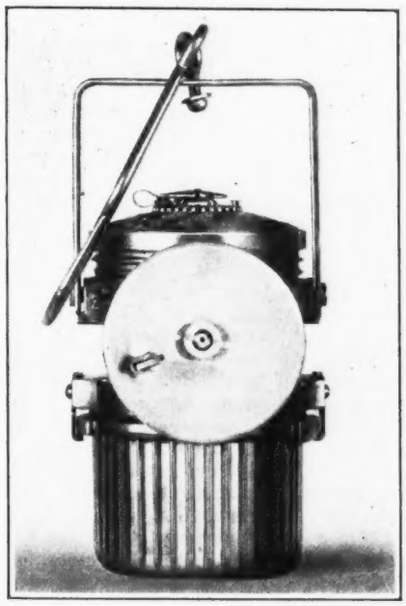
T. A. Rickard Will Address Southern California Section, A.I.M.E.

"A Journey Through South Africa" is the title of an address to be delivered by T. A. Rickard before the Southern California section of the A.I.M.E. on Oct. 20. The meeting is to be held at the Hollywood Country Club and will be preceded by a dinner dance in honor of the Woman's Auxiliary. The officers of the section are: Joseph Jensen, chairman; S. L. Gillan, secretary; W. L. Honnold, Edwin Higgins, F. S. Hudson, Hoyt S. Gale, and Rush T. Sill.

New Machinery and Inventions

Die-cast Aluminum Lamp Made in New Large Size

Some time ago the Fred R. Belt Co., Inc., 355 West Ontario St., Chicago, Ill., introduced a miner's carbide lamp of seamless aluminum. It was known as the Lu-mi-num lamp and was of the size customarily worn in the hat. The



same manufacturer has finally succeeded in producing a larger lamp of similar construction. The new lamp, a cut of which is shown, is 5½ in. high and has a carbide cup 2½ in. deep and 2⅞ in. in diameter inside. Both a bail and a sharp-pointed hook are provided with each lamp to permit it to be carried in the hand or hung from a timber.

All the parts of the new lamp are replaceable. Both the acetylene and water containers are ribbed to facilitate rapid cooling. By means of a double-cam locking device, the use of screw threads on the lower and upper chamber, a frequent source of trouble in older lamps, is avoided. The cup locks in position with a slight turn, holds tight against the rubber gasket, and can be quickly removed. An improved valve seat is provided with three extended prongs, which turn with the valve lever and cut away the sludge which accumulates around the valve. The valve is adjustable and can be readily removed for cleaning. The water tube is cast solid with the lamp and cannot be taken out. A baffle plate takes the place of the usual filtering felt, and a small wad of cotton is inserted in the gas pocket behind the tip. The tip holder screws into the lamp and is slotted so as to be readily removed with the edge of a coin. A lava or metal tip can be used. The tip is deep-seated, protecting the flame from air currents. A reflector is provided with both the large and the small types of lamps.

The regular miner's cap lamp weighs 6¼ oz. and holds 1½ oz. of carbide, sufficient for two hours. The large size lamp, provided with a bail and hook, weighs 26 oz. and has a capacity of five to six hours. The walls of the large lamp, exclusive of the ribs, are $\frac{3}{32}$ in. thick. The use of aluminum, the ease with which the lamp can be repaired, and the convenience of charging make the lamp a decided improvement over many older types.

On the Coast the lamp is handled by the E. D. Bullard Co., 565 Howard St., San Francisco, Calif.

A New Aluminum-Graphite Paint for Metal Work

Both aluminum and graphite paints have established for themselves a wide field of usefulness for coating metal surfaces. A combination of the two, forming an unusually durable light-colored paint, has just been put on the market by the Joseph Dixon Crucible Co., of Jersey City, N. J. The company will be glad to send full details to any paint user who may be interested. The new product is recommended for all exposed metal work. It is composed of aluminum combined with flake silica-graphite pigment and boiled linseed oil. Aluminum, when used for paint making, is of flake form and when combined with the Dixon pigment, each flake laps over, after the manner of fish scales, forming a covering of great elasticity and durability. Dixon's aluminum-graphite paint is equally as durable as Dixon's red lead-graphite primer and regular Dixon's silica-graphite paint. Its luster is slightly less than a straight aluminum paint, but it is pleasing to the eye.

Gases, fumes, acids, smoke, and other deteriorating agents are said to have little effect on Dixon's aluminum-graphite paint. It will retain its color after light-colored paints have darkened. It will resist the natural enemies of paint sunlight, air, and moisture. It reflects light and heat, which should make it an industrial paint of great value. When used on oil storage tanks, it will keep the temperature of the contained oil 10 deg. lower than that of oil in tanks painted with dark-color paints. This also applies to refrigerator cars and tank cars, where coolness is desired, even though exposed to the direct rays of the sun.

The new paint can be sprayed or brushed on, though the use of the paint brush is recommended. It can be brushed on over a dark coat of paint, one coat being sufficient to cover properly the under surface.

Industrial Bulletins

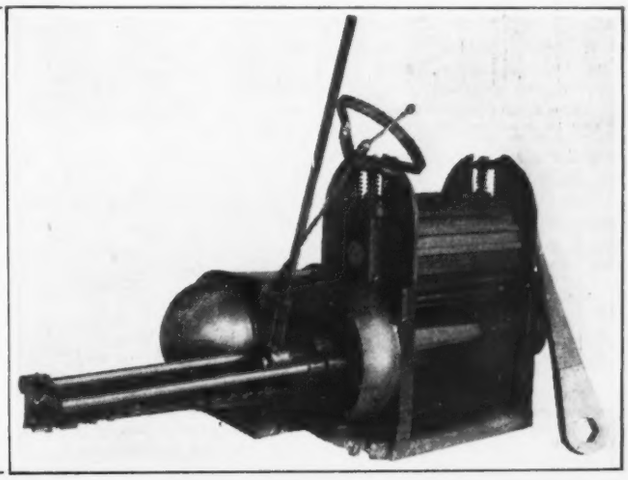
Industrial Cements—A patented line of cement fillers, damp-resisting cement paints, tank coatings, pointing cements, roof coatings, and roof cements is described in two bulletins recently issued by the Stone & Tar Products Co., 97 South 6th St., Brooklyn, N. Y. Material of this kind is of especial utility in the mining field in preventing leaks and corrosion in concrete, wooden, or steel tanks, all of which are so widely used.

Welding Data—"Properties of Steel Filler Rods for Gas and Electric Welding" is the title of an informative booklet prepared by the Chicago Steel & Wire Co., 103d St. and Torrence Ave., Chicago. The material is new, the subject matter having been recently developed by the company's research department, and the booklet should furnish an authoritative answer to the numerous questions that often arise in the minds of welders.

A Machine for Bundling Scrap Metal

In many plants the salvage of scrap metal, if followed up systematically, would be of value, and the machine here illustrated, which has been recently developed, makes scrap handling considerably less of a bother. The machine compresses tightly into bundles, without shearing, tangled wire, old tin roofs, wire cable, or other troublesome materials. The driving mechanism is capable of transmitting 25 hp., and this insures a positive action with a minimum of wear. Clutches for both forward and reverse motion are the expanded metal ring type, and the power can be applied by belt direct from a line shaft or by a direct-connected electric or gasoline motor. This bundler is manufactured by S. H. Garrett, 234 North 13th St., Philadelphia, Pa.

Handling scrap metal is made easier by use of this machine



The Market Report

Zinc and Tin Climb; Copper Weakens

Slight Premium Prices on Lead Still Obtainable—Volume of Business Fair to Good in All Metals

New York, Oct. 7, 1925—Sales of all the non-ferrous metals during the week ending today have been in good volume, though copper and zinc seem less active today than on preceding days. Total transactions in copper are larger by 50 per cent than in either of the last two weeks in September. Tin has been particularly active and lead continues in steady though not exceptional demand, with premiums obtainable in both Eastern and Mid-Western markets, particularly for spot shipment. The reaching of a truce on the French debt question at Washington has had no decided effect upon the markets as yet, but it is expected that with active consideration of the matter postponed, sentiment abroad should improve and that this should be reflected in better buying. Considerable disappointment is expressed among metal dealers that no real agreement was reached.

Daily Prices of Metals

Oct.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L.
1	14.20	58.75	60.375	9.50	9.25	7.90
2	14.125@14.2	58.75	60.375	9.50@9.55	9.25@9.30	7.95
3	14.175@14.375	58.75	60.375	9.50	9.25	7.95
5	14.125@14 25	58.375	60.00	9.50	9.25@9.30	7.975@8.025
6	14.125	58.875	60.625	9.50	9.25	8.00@8 05
7	14.125	59.125	60.875	9.50	9.25	8.00@8.025
Av.	14.183	58.771	60.438	9.504	9.258	7.973

*The prices correspond to the following quotations for copper delivered: Oct. 1st, 14.45c.; Oct. 2d, 14.375@14.50c.; Oct. 3d, 14.425@14.625c.; Oct. 5th, 14.375@14.50c.; Oct. 6th and 7th, 14.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
1	61 5/8	62 1/2	67 1/4	269	269 5/8	39 1/2	37 1/8	38 1/2	37 7/16
2	61 7/8	62 3/4	67 1/4	269	269 3/4	39 3/4	37 1/4	38 7/8	37 5/8
5	61 5/8	62 1/2	67	268 3/4	269 1/4	39 1/2	36 7/8	39 5/16	37 13/16
6	61 1/4	62 1/4	66 1/2	269 3/4	270 1/2	39 3/16	36 1/2	39 9/16	38 1/16
7	61 3/8	62 1/4	66 5/8	271	272	38 7/8	36 3/8	39 9/16	38 1/4

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
1	4.83 3/4	71 1/8	32 15/16	84s11 1/2d	5	4.83 5/8	70 7/8	32 15/16	84s11 1/2d
2	4.83 5/8	70 7/8	32 7/8	84s11 1/4d	6	4.83 3/4	70 7/8	32 13/16	84s11 1/2d
3	4.83 5/8	70 3/4	32 7/8		7	4.83 7/8	71 1/8	33 1/8	84s11 1/2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Not Too Strong at 14.375c. Delivered

There has been a wide range in copper prices during the week. On Thursday, Friday, and Saturday large tonnages brought 14.625c. at high freight rate points in the Middle West and good sales were made at 14.50c. in the East. On the same days copper changed hands in good volume at 14.375c. except for Saturday, when 14.425c. was the lowest realized on a large transaction. Since Monday 14.375c. has been the prevailing figure, though that has been shaded slightly where the delivery charge has been nominal. Some foreign business has materialized in the last few days. Although the tonnage has not been large, producers are encouraged at finding any market in Europe. As much as 14.65c. c.i.f. has been obtained by leading producers. However, other sales have been made at 14.50c. c.i.f. and at 14.25c. f.a.s. Probably 5,000 tons or more has been sold for foreign consumption. Producers generally are pretty well sold for October and the bulk of the business is for November-December delivery.

Lead Active in the Middle West

The American Smelting & Refining Co. continued its official contract price at 9.50c. delivered at New York. In the Middle West the leading producer sold freely at 9.25c. for October and even into November and December. At the same time enough metal was sold on a basis of 9.35c. St. Louis to be reflected in the quotations for the week.

The principal strength of the domestic market seems to be in the demand from cable makers, their takings in proportion to other industries being larger than ever before. Paint makers are active buyers, but in the battery industry buying is dull.

Zinc at New High Since 1920

Passing 8c., the zinc market reached its highest point since 1920. The brisk demand from Europe has been a helpful factor. Expansion in the galvanizing activity both in England and in America has helped. On Tuesday the price of high-grade zinc was marked up to 9¼c. by leading producers, demand for this quality being excellent. Sellers have little metal to dispose of and the entire position is excellent. A wage agreement with smelter employees in the Middle West calls for a wage bonus when Prime Western passes 8c. However, the bonus is removed when the market is below that figure.

Tin Reaches 60⅞c.

Possibly the realization that the visible supply of tin totals only 17,000 tons, with invisible stocks also very low, has influenced consumers, who have been holding off, to come into the tin market. Temporary dullness appeared on Monday, but since then the price has stiffened to 60¼c. for spot and 60¾c. for November and December delivery.

CORRECTION—The price of spot tin in London on Sept. 30 was incorrectly received and published in the Oct. 3 issue as £268½. The correct figure was £266½, and the correct average price for September was £259.091.

Sterling Reaches Gold Point

Sterling exchange has strengthened slightly since it was announced that gold was being shipped from England to the United States. Francs and lire are lower on account of the failure to arrange for the funding of the French debt. Closing cable quotations on Tuesday, Oct. 6, were as follows: francs, 4.5925c.; lire, 4.015c.; and German marks, 23.805c. Canadian dollars, 3/32 per cent premium.

Silver Remains Quiet

A quiet market has prevailed recently both in New York and abroad, but on the 7th a sharp advance for prompt delivery, caused by orders from China and India occurred in the London rate. Their market turned easy toward the close, however, and this position was reflected in the relatively small advance in New York prices. The U. S. Government purchased 500,000 oz. on Oct. 5, making a total of 1,350,000 oz. since the first of September.

Mexican Dollars: Oct 1st, 54⅝c.; Oct. 2nd, 54⅝c.; Oct. 3rd, 54¼c.; Oct. 5th and 6th, 54⅝c.; Oct. 7th, 54⅝c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118@£120 per long ton.

Antimony—

Chinese brands, spot, 17¼c. per lb.; October, 16¾@17¼c.

Demand is only moderate but arrivals are scant and price is firm for spot.

Cookson's "C" grade, needle, and oxide nominally unchanged from quotations in the Oct. 3 issue.

Bismuth—$2.65@$2.70 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. London, 1s. 9d.

London has declined from 2s. 3d., but the domestic market is firm.

Iridium—$395 per oz. for 98@99 per cent. Nominal. London, £80@£85.

Nickel—Ingot, 33@34c.; shot, 34@35c.; electrolytic, 38c.; London, £170@£175 per long ton.

Palladium—$78@$83 per oz. Crude, $65. London, £16, nominal.

Platinum—$120 per oz. refined officially quoted. Sales also at $115@$118. Crude, $113.50@$114. London, £25 per oz. for refined; crude £22 5s. @ £22 10s.

Quicksilver—$81.50@$82.50 per 75-lb. flask. San Francisco, $80.83. London, £12 7s. 6d.@£13. Market dull.

Ruthenium—$90@$95.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten** and **Zirconium** are unchanged from the Oct. 3 issue.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Brazilian, 42@44c., nominal; Indian, 44c., nominal; Caucasian (unwashed), 42c.; Caucasian (washed), 44c. Demand moderate, but price firm.

Tungsten Ore—Per unit of WO_3, N.Y.: High-grade wolframite, $12.25. Ordinary quality, $11.50@$12; high-grade Western scheelite, $12@$12.50. Market quiet as a consequence of large buying during the last month. Consumers fairly well covered for remainder of the year.

Chrome Ore — Indian ore — second grade—offered c.i.f. New York at $19 per long ton. High-grade Indian ore, $22@$23. Rhodesian ore offered at $23. Prices largely nominal.

Galena and **Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum,** and **Vanadium Ores** are unchanged from quotations in the Oct. 3 issue.

Zinc and Lead Ore Prices Unchanged

Joplin, Mo., Oct. 3, 1925

Blende	Per Ton
High	$58.90
Premium, basis 60 per cent zinc	$56.00@$57.00
Prime Western, 60 per cent zinc	$55.00@$56.00
Fines and slimes, 60 per cent zinc	$54.00@$51.00
Average settling price, all	$54.14
Galena	
High	$131.70
Basis 80 per cent lead	$115.00
Average settling price, all	$121.39

Shipments for the week: Blende, 15,852; galena, 2,228 tons. Value, all ores for the week, $1,124,670.

Sellers are still loading lead ore sold several weeks ago on $120 to $125 basis price, and only a small portion of the shipment is ore sold on the quoted basis price today. A slight tonage of Prime Western was reported sold on $56 basis, the bulk of sales being on $55 basis. Production is around 16,500 tons per week, with an increasing tonnage being sold for export. S. N. Fox, of New York City, has been in the district a week and has made tentative arrangements with a local buyer of zinc ore to purchase ore for export, ostensibly for the firm of Lemoine, Bies & Harang, of Paris.

Platteville, Wis., Oct. 3, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$57.75
Lead Ore	
Lead, basis 80 per cent lead	$125.00

Shipments for the week: Blende, 981 tons; lead, 40 tons. Shipments for the year: Blende, 36,141; lead, 1,721 tons. Shipments for the week to separating plants, 1,437 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Oct. 3 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3.50c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from prices in the Oct. 3 issue.

Ferro-Alloys

Ferrotungsten — $1.15 per lb. contained W. Market firm, with tendency toward better price.

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium and **Ferrovanadium** are unchanged from the prices in the Oct. 3 issue.

Metal Products

Rolled Copper — Sheets, 22¾c.; wire, 16½c. per lb.

Nickel Silver—29¼c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Sheets, 20½c. per lb.; rods, 17½c.

Lead Sheets—Rolled, 13¼c.; clipped, 13½c.

Zinc Sheets—11c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite** are unchanged from prices in the Oct. 3 issue.

Demand for Steel Sustained—Pig Iron and Coke Dull

Pittsburgh, Oct. 6, 1925

In no quarter has demand for steel shown any tendency to decrease in the past week, and comparisons with thirty days ago show in most cases slightly heavier demand. At the same time there is no evidence of either distributors or manufacturing consumers increasing stocks, making it clear that steel consumption is at a high rate.

Black sheets are somewhat easier, being now quotable at 3.05c. to 3.15c., with other descriptions of sheets fully as firm as they were a fortnight ago. Plates, shapes, and bars present a firmer tone, concessions from regular prices being less frequent.

Pig Iron—The market remains dull in Pittsburgh-Valley territory, with prices perfectly firm. Bessemer, $19.50; basic, $18.50; foundry and malleable, $19, f.o.b. Valley furnaces.

Connellsville Coke—The market remains dull in general, but has picked up a trifle. Spot furnace, $3.50@$3.75; spot foundry, $4@$4.50.

Situation at the Mines

By Albert H. Fay
Assistant Editor

The increasing price of lead, silver, and zinc is having a very beneficial effect on the mining industry as a whole, since there is a renewed activity in all of the districts wherein these metals are produced. With the increased activity reports indicate in most cases a plentiful supply of mine labor. The copper industry did not fare so well during the month, as there was a slight decline in the price of the red metal. This, however, is offset in case of those mines that are fortunate in having a good percentage of lead, silver, and zinc as byproducts.

Average Metal Prices

Period	Copper	Lead	Zinc	Silver
April	13.252	8.005	6.985	66.899
May	13.347	7.985	6.951	67.580
June	13.399	8.321	6.990	69.106
July	13.946	8.151	7.206	69.442
August	14.490	9.192	7.576	70.240
September	14.376	9.508	7.753	71.570

Copper—Refined copper production in the Michigan district in September is estimated at 14,650,000 lb. Of this amount Calumet & Hecla produced 9,300,000 lb. The reclamation of copper from tailing dumps is becoming an important factor in the matter of production, as, for example, the Calumet reclamation plant produced 2,000,000 lb. and the Tamarack plant 1,000,000 lb. during September. Copper has been moving out of the lake districts freely by both boat and rail and shipments to the Middle West points have been heavy. Prospects for October deliveries are good and it is predicted current production will be absorbed throughout the remainder of the year. Steady shipments of copper have left the smelters in the Michigan district with very small stocks of metal. It reflects an improved demand for lake copper. Rail shipments are the heaviest in years, principally to Chicago and lower Michigan automobile centers. Shipments to Eastern points are smaller in volume than usual. The Lake Superior mines continue to install labor-saving devices and to extend electricity to underground hoists and new pumping systems.

The Kay Copper Co. in Arizona is active in development work and has opened a good deposit of 3½ per cent copper ore. Miami Copper Co. operated at full capacity of 10,000 tons per day, while Inspiration remained at about 66 per cent capacity during the month. The Noranda Mines, Ltd., adds to its directorate preliminary to financing for an extensive development program of recently discovered copper and gold ores in northern Quebec.

The Mammoth smelter at Kennett, Calif., after operating 21 years, closed on Sept. 1. As indicative of the status of the mining industry as a whole may be cited the earnings of the American Smelting & Refining Co. for the first six months of 1925, which were $608,000 above those of a like period in 1924 and $883,000 larger than the last half of 1924.

Silver—The average price of silver for the month of September was 71.57c. per ounce, which is the highest for many months. This high price has had the effect of stimulating activity at all of the silver mines as well as those which are producing silver as a byproduct.

Lead-Silver Mines—Under the stress of good metal prices the Coeur d'Alene mines in Idaho operated at maximum capacity, the September shipments amounting to 21,000 tons of high-grade ore and concentrates. New development work in this district is hardly keeping pace with production. There are a number of ventures that give promise of bringing in additional productive mines soon. The development of the Pine Lake District, Idaho, is waiting upon the action of the railroad company. Many prospective mines are now employing a large number of men, giving ample employment for all laborers. In Utah the reports available at the close of the third quarter of the year show that the metal mines of the state paid dividends at the rate of $13,000,000 per year, as compared with a total of $9,700,000 in 1924, thus indicating the prosperity of the industry in that state, which may be taken also for an index for operations in other lead- and silver-producing states. The flotation plant of the Leadville Mines Co. in Nevada was destroyed by fire early in September. In British Columbia the Consolidated Mining & Smelting Co. of Canada is in search of new ore supplies and as a result has located a number of claims near Ymir, B. C. The Federal Mining & Smelting Co. purchased the Sally mine, in the Boundary district, British Columbia.

Lead Mines—The Eagle-Picher Lead Co., of Joplin, Mo., has constructed a new factory for expanding its manufacturing business. There has been considerable activity in the Galena district of Kansas, resulting in the transfer of a number of mining properties and the reopening of abandoned mines. In Utah, the Utah Apex is producing at the rate of 4,000,000 lb. of lead per month. The National Lead Co. has purchased an interest in the Wilhelmsburg Smelting Works, Hamburg, Germany. The Grand Central Mining & Smelting Co., Fairbanks, Ariz., is developing lead- and zinc-mining properties in the Aravapai mining district. In the Tintic District, Utah, there is a revival of interest in many properties that have been idle for a number of years. New claims that may contain lead or lead and silver are being thoroughly tested.

Zinc—By reason of the closing of the smelter at Kennett, Calif., the Mammoth Copper Co. is shipping its zinc and copper ores to the flotation plant of the California Zinc Co., Winthrop, Calif. The International Minerals & Metals Corporation entered the Joplin field to purchase zinc ores for foreign shipment. The total production of zinc concentrates in the Joplin-Miami district during the month was about 20,000 tons per week. No stores of ore are on hand in excess of one or two days' supply. The value of zinc-lead shipments for nine months, 1925, is $41,813,000, or $1,130,000 per week, compared with $1,266,720 the week ended Sept. 26.

At Rico, Colo., there is a revival of the mining industry due to the present price of zinc and lead and the improved methods in metallurgy whereby zinc is saved. The International Smelting Co. is active in this district and is opening up a number of the old mines and is also making ore contracts with other operators. The Coeur d'Alene district, Idaho, shows a decided increase in its byproduct zinc.

Gold Mining—A shortage of water in Alaska has hampered operations in the Kotzebue Sound district. Dredging operations, however, have not been interfered with at Nome. In South Africa the attention of the investors has been turned to the abandoned or what were presumably exhausted gold mines, where important development work is now in progress. Encouraging reports have been made on placer deposits along the Hassayampa River, Arizona, preliminary to the installation of dredges. The recent copper-gold discoveries in the Rouyn district, Quebec, are attracting considerable attention as well as capital, and promise early development. The Canadian gold mines already developed are working at full capacity, the Porcupine district alone producing 770,000 oz. in eight months. In British Columbia, the Premier Gold Mining Co. declared a quarterly dividend of $400,000, or 32 per cent per year.

Iron—Lake iron ore shipments continue at the rate of about 57,000,000 tons per year, or possibly 10,000,000 tons in excess of 1924. All work was suspended Labor Day, as the dockmen laid off and left no empty cars for the mines. The York mine of Coats & Tweed Co. at Nashwauk completed its season's shipment of 50,000 tons the middle of the month and closed down. The Hawkins mine of the same place, operated by the Wisconsin Steel Co., cleaned up its washing operations and shut down its concentrator, using its stock pile to complete the season's shipment of about 400,000 tons. The shipments of ore from the State leases are approximately 1,000,000 tons per month.

General—The Phoenix Stone Co., recently acquired by the Standard Stone Co., has been reorganized and has purchased 1,600 acres of soapstone deposits in Virginia which will be placed under development at an early date. An important discovery of diamonds is reported in Tanganyika, Africa. The Guggenheim brothers have acquired a large area of placer tin deposits in Bolivia, which will be operated in connection with other holdings. The platinum development in Africa occupies the public attention, although a definite process for recovery of the metal has not been developed. The International Nickel Co. recently declared its first common dividend in five years. In Brazil there is a labor shortage at the mines, due to the fact that higher wages are paid in the coffee and rubber industries.

Benno Elkan Likens European Condition To That of a Sick Man

An Interview With the First Vice-President of the International Minerals & Metals Corporation, Who Recently Spent Three Months Abroad

By Arthur B. Parsons
Assistant Editor

"SUPPOSE that a normally active man for some reason has undergone four or five major surgical operations in rapid succession. His doctors assure him that ultimately he will be as sound and vigorous as ever; but the process of mending will take time. They warn him that he is likely to have set-backs. If he eats too much, or drinks too much; if he gets too much excitement or too much work; if he is subjected to any kind of excess, he is sure to have temporary relapses. But these will not mean that he is not making constant progress toward recovery."

Thoroughly Understands Conditions

This is the way Benno Elkan, first vice-president of the International Minerals & Metals Corporation, recently answered a question as to his impressions of the situation in Europe. Mr. Elkan's company controls the Norfolk copper smelter in Virginia and the smelters of the National Zinc Co. at Bartlesville, Okla., and at Springfield, Ill., and does extensive trading in these metals in both American and European markets.

So many unsophisticated Congressmen and Prominent Citizens have aired their views on the economic status of Europe, after spending a few weeks following the beaten track of tourist travel on the other side, that Americans are not inclined to take what they say very seriously. However, Mr. Elkan is in quite a different position. Prior to 1905 his home and his business were in Europe. He knows the leaders of industry there, particularly in the mining and metal business; and he understands conditions. He has just returned from a three-month visit.

The recent serious decline in the European purchases of metals, particularly of copper, following the very active period of the first half of the year, is a symptom of a relapse in a sick continent. "Conditions may not improve immediately, but they will in time," says Mr. Elkan. "Even then we should not be surprised if other distressing periods of reaction follow. But the underlying trend is in the right direction. The Dawes plan supplied a foundation, and vast progress has been made during the last year. The attitude of the people is changing. They are realizing more clearly the fact that economic rather than purely political considerations must be their guide. The industries of one country cannot well thrive unless those of its neighbors enjoy some measure of prosperity.

TIME, according to doctors, is the principal ally of a patient recovering from a serious surgical operation. The rebuilding of tissue, the re-establishment of the nerve connections and channels for the flow of blood are slow processes. The entire body suffers from the disorganization. Even when the processes of rebuilding are progressing favorably, any slight excessive nervous or muscular strain is likely to cause temporary relapses. These, however, should not be considered as causes for undue pessimism. Mr. Elkan likens Europe to a patient that has been operated on, and that is gradually recovering. He says that depressing reactions in the economic situation are to be expected. His view as to the importance of the full development of Russia as a prerequisite to permanent prosperity in continental Europe is worthy of careful consideration.

"German municipal and state governments are in sound financial condition and they are spending large amounts of money on public works. Important among these are the improvement and expansion of transportation systems and other public utilities. Manufacturing industries, for the time being, are badly handicapped by lack of capital. The period in inflation diminished the working capital of many companies by from 50 to 75 per cent, and definite recovery necessarily will be a gradual process.

High Interest Rates and High Railway Tariffs Increase Costs

"Current interest rates are from 12 to 16 per cent, and this item alone imposes a big handicap on many manufacturers who are obliged to compete in foreign markets. Another factor that increases the cost of production is high freight rates on the railroads. Naturally some enterprises have collapsed and other have been forced to curtail operations. This is reflected in unemployment and incidentally the capacity of the country to absorb metals and other raw materials."

Mr. Elkan observes a definite tendency to get away from the cartel system. Under this method of industrial organization, important interests engaged in one stage of production combine to form price-fixing syndicates. The selling price usually is adjusted so as to permit a profit to the producer with the highest costs, so that profits realized by the more efficient are excessive. As a cartel is a horizontal rather than a vertical combination, the profits tend to pyramid and the cost of the finished product is higher than it ought to be. "The trend," says Mr. Elkan, "is toward reorganization along the lines of the U. S. Steel Corporation, so that one closely allied group will conduct operations from the raw material to the finished product stage. This should reduce costs and help to expand export trade. Germany's present enormous unfavorable visible trade balance must be improved if adequate payments under the Dawes plan are to be possible."

Agricultural Districts Active

A favorable sign for the near future is general activity in the agricultural districts. Reports of like nature come from France, Italy, Austria, Roumania, and other countries on the Continent. There is little unemployment in either France or Italy. Mr. Elkan regards the recovery of Russia as vital. He says:

"In my opinion the ultimate return of Europe to economic health depends upon Russia. That country has vast natural resources that eventually will be developed. Russia, with its huge population, is the natural market for railroad equipment, for electrical and other machinery, and for manufactures of every description. She can pay for these with wheat and other food products, as well as with the products of her mines. There are, I think, unmistakable signs that we shall see before long the development of an industrial Russia on a scale that will dwarf anything of pre-war times. By this I do not mean six months or even a year. As with all big movements, many years will elapse before this development is an accomplished fact. But a good start will be made soon. This is the one thing that will really solve the problem of restoring the rest of Europe.

"In the meantime the processes of healing and recuperation after those four or five major operations will go on. It is not to be expected that all the old markets and channels of trade, and the industrial and financial connections that were cut apart, will be restored. But others will be formed to take their places, and the patient, with the help of time, will get well."

Company Reports

Walker Mining Co.

Copper; California

The report of the Walker Mining Co. for the fiscal year ended July 31, 1925, states that in its main orebody there remains 465,440 tons of 4.03 per cent copper ore. It is also estimated that there is more than 900,000 tons in the north orebody above the seventh level which will average 2.22 per cent copper.

During the fiscal year, 237,286 tons of ore was delivered to the mill, with an average grade of 2.9421 per cent copper. Tailings averaged 0.1512 per cent copper; recovery, 94.3602 per cent; concentrates, 24.7763 per cent copper. The ore carried an average of 1.13 oz. silver and 0.042 per cent gold. A total of 23,980 tons of concentrates was reduced.

Balance Sheet July 31, 1925

Assets

Fixed		
Mine, mining claims, and development	$1,680,749.36	
Plant and equipment	1,313,835.05	$2,994,584.41
Current		
Supplies on hand and expenses prepaid	$145,193.98	
Ores and concentrates on hand—at cost	356,707.23	
Accounts receivable	17,279.29	
Cash	56,211.36	575,391.86
		$3,569,976.27

Liabilities

Capital stock		
Common		
Authorized—1,750,000 shares of $1 each		$1,749,308.00
Issued—1,749,308 shares		296,342.58
Reserve for depreciation		999,604.64
Notes payable		
Current		
Interest and taxes accrued	$24,501.63	
Accounts and wages payable	98,892.20	123,393.83
Surplus account		
Surplus July 31, 1924	133,461.83	
Net income of the year ending July 31, 1925	267,865.39	401,327.22
		$3,569,976.27

Income Account Year Ended July 31, 1925

Sales of ore and concentrates		$1,526,007.74
Mining and milling	$921,126.29	
Transportation	168,143.65	
Inventory at beginning of year	293,632.44	
	$1,382,912.38	
Less inventory at end of year	356,707.23	1,026,205.15
Operating profit		$499,802.59
Depreciation	$157,459.40	
Interest	67,748.33	
Interest on preferred stock	6,729.47	231,937.20
Net income of the year ended July 31, 1925		$267,865.39

The cost of production exclusive of depletion, depreciation, interest and federal taxes was 9.485c. per pound of copper.

American Smelting & Refining Co. and Subsidiaries

Various; United States and Mexico

The report of the American Smelting & Refining Co. and its subsidiaries for the first half of 1925 states that the period showed a continuation of the steady improvement in the company's affairs which has been manifest for several years. After deducting all bond interest, depreciation, obsolescence, ore depletion, and taxes (including estimated federal taxes), there was a net income of $6.378,916.24, an increase of $688,379.02 over the corresponding period of last year and an increase of $882,462.75 over the last six months of 1924. After further deducting dividends on the preferred stock for the six months, amounting to $1,750,000, the company earned upon the common stock $4,628,916.24, an earning per share for the six months' period of $7.59, which is at the rate of $15.18 per annum. In the first six months, the company earned more than sufficient to pay the dividend for the entire year at the present rate on the common stock. There is no indebtedness to banks. At the end of the period, the company had on hand, in cash, call loans, bankers' acceptances, and government securities, $27,689,141.91, or $1,374,152.04 over Dec. 31, 1924.

Consolidated General Balance Sheet June 30, 1925

Assets

Capital assets		
Property		
Cost of plants, properties of subsidiary companies, and additions and improvements, less depreciation, ore depletion, and additions and improvements written off to profit and loss		$120,955,940.74
Investments—Securities of and advances to affiliated companies		5,249,351.82
Total capital assets		$126,205,292.56
Current and miscellaneous assets		
Total cash, government securities, etc	$27,689,141.91	
Accounts receivable	11,511,202.13	
Notes receivable, due in 1925	45,309.88	
Materials and supplies	7,758,111.76	
Metal stocks (not including metals treated on toll basis) less unearned treatment charges	35,803,579.18	
Miscellaneous	5,232,665.80	
		88,040,010.66
		$214,245,303.22

Liabilities

Funded debt and capital stock		
Bonds outstanding		
American Smelting & Refining Co. Series "A" 5 per cent first-mortgage bonds, 1947		$40,311,100.00
American Smelting & Refining Co. Series "B" 6 per cent first-mortgage bonds, 1947		9,571,000.00
Total bonds outstanding with public		$49,882,100.00
Preferred capital stock—authorized and outstanding		50,000,000.00
Common capital stock—authorized	65,000,000.00	
Less unissued	4,002,000.00	
Issued and outstanding		60,998,000.00
Total funded debt and capital stock		$160,880,100.00
Current and miscellaneous liabilities		17,727,452.34
Reserves and profit-and-loss surplus		
Reserves		
Extraordinary obsolescence, contingencies and additional amortization of war facilities	$4,893,757.94	
Employees' pension	2,809,252.51	
Metal stock	8,350,231.30	
Total reserves	$16,053,241.75	
Profit-and-loss surplus	19,584,509.13	
Total reserves and profit and loss surplus		35,637,750.88
Total liabilities		$214,245,303.22

Summary of Consolidated Income and Profit-and-Loss Surplus Account

	Six Months Ended June 30, 1925	Six Months Ended June 30, 1924
Net earnings of smelting and refining plants and industries immediately dependent thereon	$10,284,835.69	$9,111,113.70
Net earnings of metal mines	1,624,960.64	1,712,222.71
Total net earnings of operating properties	$11,909,796.33	$10,823,336.41
Other income, net		
Interest, dividends received, commissions, etc	582,751.17	659,658.04
Net earnings, before deducting general and administrative expenses and corporate taxes	$12,492,547.50	$11,482,994.45
Deduct		
General and administrative expenses	$663,265.90	$682,461.50
Research and examination expenses	117,967.37	99,601.85
Corporate taxes (including estimated federal taxes)	897,315.03	735,085.69
Total to deduct	$1,678,548.30	$1,517,149.04
Net income from current operations, before providing for bond interest, depreciation, obsolescence and depletion, and after providing for all taxes	$10,813,999.20	$9,965,845.41
Deduct		
Interest on first-mortgage bonds outstanding with public:		
Series "A" 5 per cent	$1,010,935.46	$1,027,661.17
Series "B" 6 per cent	284,905.14	289,406.20
Depreciation and obsolescence	2,066,090.00	2,094,296.03
Ore depletion	1,072,552.36	863,944.79
Total to deduct	$4,435,082.96	$4,275,308.19
Net income	$6,378,916.24	$5,690,537.22
Deduct		
Dividends on		
Preferred stock	$1,750,00.00	$1,750,000.00
Common stock	1,829,940.00	1,524,950.00
Total to deduct	$3,579,940.00	$3,274,950.00
Surplus income for period	$2,798,976.24	$2,415,587.22

Summary of Consolidated Profit-and-Loss Surplus Account

Balance at beginning of year	$16,785,532.89
Surplus income for six months, after deducting dividends	2,798,976.24
Balance at June 30, 1925	$19,584,509.13

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$10.00[1]
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	12.90	.....
Houghton, Mich.	New York	9.60	.....
Hancock, Mich.	New York	9.60	.....
Hubbell, Mich.	New York	9.60	.....
Dollar Bay, Mich.	New York	9.60	.....
Tacoma, Wash.	New York via Canal	Conference rate	$6.00
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

[1]Via Southern S.S. Co. ..... $9.40.

Marine Freight Rates

New York to
- Hamburg.... $4.50 per gross ton copper and lead
- Liverpool.... 5.50 per gross ton copper and lead
- Antwerp.... 4.00 per gross ton copper and lead
- Havre..... 4.75 per gross ton lead
- 5.00 per gross ton copper

Gulf ports to
- Hamburg.... $4.50 per gross ton copper and lead
- Liverpool.... 5.50 per gross ton copper and lead
- Antwerp.... 4.00 per gross ton copper and lead
- Havre..... 5.00 per gross ton copper

Pacific coast ports to
- Hongkong... $6.00 per short ton copper and lead
- Kobe..... 6.00 per short ton copper and lead

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	12.50	$9.00
Leadville, Colo.	12.50	9.00
East Helena, Mont	12.50	9.50
El Paso, Tex.	10.00 Via Gulf	
	12.00 All Rail	7.00
Omaha, Neb.	9.60	3.65
Murray, Utah	12.50	9.00
Midvale, Utah	12.50	9.00
Tooele, Utah	12.50	9.00
East Chicago, Ill.	6.40	(a) 1.60
Kellogg, Idaho	13.50	9.50
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(b) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E.St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50
Amarillo, Tex.	5.80	12.80

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.50
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
	Cent City Spur, Mo.	2.00
	Chitwood, Mo.	2.00
Kusa, Okla.	Galena, Kan.	1.50
Henryetta, Okla.	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product: $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	1.01
Great Falls, Mont.	East Helena, Mont.	....	....	1.57	....	1.76	....	1.98	....	2.43	....	....	....	....	....	2.55
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	6.30	7.00	7.70	....	8.35	8.60	8.85
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	4.50(c)	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	5.50	5.90	....	6.30	....	....	....	7.70
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.50	6.00	6.50	....	6.60	7.10	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	....	....	....	2.30	2.55	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	....	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C.(d)	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.11	2.56	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing.
(d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates: $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a) (d)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	.....	....	....	1.02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	....	5.12½
Park City, Utah	Salt Lake Smelters	1.00(c)	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain, Nev. (a)	Salt Lake Smelters	....	4.15	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	....	2.90	3.20	....	3.80	....	4.30	4.80	5.30	5.80	.....	6.30	6.80	7.30
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.50
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.80
Shirley, Colo.	Leadville, Colo.	....	....	2.25	....	2.25	....	2.25	2.25	4.30	4.30	.....	4.30	4.30	4.30

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton.
(e) For $9 value rate is 95c.; $8 values, 90c.; $7 value, 85c.; $6 value, 80c.
*Indicates a change of tariff since Sept. 12.

Mining Stocks—Week Ended October 3, 1925

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	44	42⅛	43⅞	Oc.17, No.23, Q 0.75
Arcadian Consol.	Boston	1	*90	*90	
Ariz. Com'l.	Boston	12⅛	12	12⅛	Jy.21, Jy 31 SA 0.50
Calaveras	N. Y. Curb	2	1⅝	1⅞	
Calumet & Arizona	New York	50⅞	50	50⅛	Se.4, Se.21 Q 1.00
Calumet & Hecla	Boston	50⅞	50	50⅛	Au.31, Se.15 Q 0.50
Canario Copper	N. Y. Curb	8	7⅛	7⅛	
Cerro de Pasco	New York	53⅛	51⅞	52⅝	Au.21, Se.1, Q 1.00
Chile Copper	New York	34⅝	33⅛	34⅛	Sep. 2, Sep. 28, Q 0.62½
Chino	New York	21⅛	21	21	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	2⅞	2⅝	2⅞	
Copper Range	Boston	20⅛	19⅛	20⅛	Ap.9, My.4 1.00
Crystal Copper	Boston Curb	*40	*30	*32	
East Butte	Boston	4⅛	4	4	Dec., 1919 0.50
First National	Boston Curb	*16	*16	*16	Feb., 1919 0.15
Franklin	Boston	*1 1/16	*80	*90	
Granby Consol.	New York	19	17⅛	19	May, 1919 1.25
Greene-Cananea	New York	12⅛	12⅛	12⅛	Nov., 1920 0.50
Hancock	Boston	*75	*75	*75	
HoweSound,new,r. t.c.	New York	24⅞	23⅛	24⅛	Oc.5, Oc.15 Q 0.50
Inspiration Consl.	New York	27⅞	25¼	27⅛	Se.17, Oc.5, Q 0.50
Iron Cap	Boston Curb	3⅜	2⅞	3⅛	May, 1923 0.15
Isle Royale	Boston	12⅝	11⅝	12	Sept., 1923 0.50
Jerome Verde Dev	N. Y. Curb	*75	*50	*50	
Kennecott	New York	54⅛	53⅛	54⅛	Se.11, Oct.1 Q 0.75
Lake Copper	Boston	1⅛	1⅛	1⅛	Jn.1, Jn 15 Q 0.50
Magma Copper	NewYork	42⅞	41⅛	42⅛	Oct.1, Oct.15, 0.75
Mason Valley	N. Y. Curb	2⅛	2	2⅛	
Mass Consolidated	Boston			*80	Nov., 1917 1.00
Miami Copper	New York	9⅛	9	9⅛	Au.1 Au.15 Q 0.25
Mohawk	Boston	32	30⅛	32	Aug. 1, Sept. 2 1.00
Mother Lode Coal	New York	7⅛	7⅛	7⅛	Jn. 12, Jn. 30 0.37½
Nevada Consol.	New York	13⅜	12⅛	13⅛	Sept., 1920 0.25
New Cornelia	Boston	19	19	19	Aug. 7, Aug. 24 0.25
North Butte	Boston	1⅛	1	1⅛	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	*87	*80	*81	No.14, De.2 0.05
Old Dominion	Boston	19⅛	18⅛	18⅛	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†131	†130		Se.19, Oc.2 Q 1.00
Quincy	Boston	24⅛	23	23	Mar., 1920 1.00
Ray Consolidated	New York	13⅛	13	13⅛	Dec., 1920 0.25
Ray Hercules	N. Y. Curb			14	
St. Mary's Min. Ld.	Boston	34⅛	33⅛	34	Ap. 20, My.20, 3.00
Shannon	Boston	*55	*55	*55	Nov., 1917 0.25
Shattuck Arizona	New York	6	5⅞	5⅞	Jan., 1920 0.25
Superior & Boston	Boston	1	1	1	
Tenn. C. & C.	New York	13	10⅜	12⅞	De.31, Ja.15,Q 0.25
United Verde Ex.	N. Y. Curb	26⅛	26	26⅛	Oc. 6, Nov. 20 0.75
Utah Copper	New York	*95⅛	*95	*95⅛	Se.18, Se 30, Q 1.00
Utah Metal & T.	Boston	*86	*80	*81	Dec., 1917 0.30
Victoria	Boston			*40	
Walker Mining	Salt Lake	2.05	1.75	2.80	
NICKEL-COPPER					
Internat. Nickel	New York	34	33	33	Se.11, Se.30, Q 0.50
Internat. Nickel pfd.	New York	99⅛	99⅛	99⅛	Jy.16, Au.1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	15⅛	.15	15	
Glad-tone M. M. Co.	Spokane	*25⅛	*24	*24	Jy. 1, Jy. 10 0 01
National Lead	New York	161⅛	156	159	Sep.11, Sep.30 2.00
National Lead pfd.	New York	116	116	116	Aug.21, Sep.15 1.75
St. Joseph Lead	New York	44⅞	43	43⅛	De.10,De.21Q Ex 1.50
ZINC					
Am. Z. L. & S.	New York	7⅛	7⅛	7⅛	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	30⅛	30⅛	30⅛	Nov., 1920 1.50
Butte C. & Z.	New York	6⅞	6	6⅛	De.10, De.24 0.50
Butte & Superior	New York	11⅝	10⅜	11⅛	Se.18, Se 30 0.50
Callahan Zn-Ld.	New York	2⅛	2	2⅛	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb			193⅛	Jn.20, Jy. 10 Ex 2.00
United Zinc	N. Y. Curb			*35	
Yellow Pine	Los Angeles	*70	*69	*70	Se.10 Se.21 Q 0.04
GOLD					
Alaska Juneau	New York	2	2	2	
Argonaut	Toronto	*24	*22	*23⅛	
Barry-Hollinger	Toronto	*19⅛	*18	*19	
Carson Hill	Boston	*30	*25	*25	
Consol. W. Dome L.	Toronto	*12⅛	*11	*12⅛	
Cresson Consol. G.	N. Y. Curb	2⅝	2⅜	2⅜	Se.30, Oc.10 0.10
Crown Reserve	Toronto	*17⅛	*16	*17	Jan 1917 0 05
Dome Mines	New York	15	14⅜	14⅜	Se.30, Oct.20, Q 0.50
Golden Cycle	Colo. Springs			1.51	Dec.11, 1924 0.03
Hollinger Consol.	Toronto	15.60	15.45	15.55	Se.21, Oc. 7 0.08
Homestake Mining	New York	49	48⅛	49	Se.19 Se.25 M 0.50
Kirkland Lake	Toronto	*36⅛	*34	*36	
Lake Shore	Toronto	7.94	7 80	7.90	Se.1, Se.15. 0 05
McIntyre-Porcupine	New York	19⅜	19⅛	19⅜	Aug.1, Sept.1 0.25
Newray	Toronto	*23⅛	*22⅛	*23	
Night Hawk Pen.	Toronto			*20	
Portland	Colo. Springs			*43	Oct., 1920 0.01
Rand Mines	New York	36	35⅛	36	Au.17, Au.25 1.52
Teck-Hughes	Toronto	1.97	1.91	1.94	
Tom Reed	Los Angeles	*60	*42	*42	Dec., 1919 0.02
Tough-Oakes	Toronto	*54	*49⅛	*53⅛	
United Eastern	N. Y. Curb	*52	*51	*52	July, 1924 0.05
Vspond Cons.	Toronto	1 07	1.02	1.06	
Wright-Hargreaves	Toronto	6.16	5.90	6.07	Se.15, Oc.1 Q Ex. 0.5
GOLD AND SILVER					
Black Oak	N. Y. Curb			*81	
Con. Cortez	N. Y. Curb	8	*8	*8	
Con. Virginia	San Francisco	5⅛	4⅛	4⅛	
Continental Mines	N. Y. Curb			1	
Dolores Esperanza	N. Y. Curb			*50	July, 1923 0.05
Premier Gold	N. Y. Curb	2⅜	2⅛	2⅛	Se.18, Oc.3, 0.08
Tonopah Belmont	N. Y. Curb	*70	*70	*70	Sep. 15, Oct. 1, 0.05
Tonopah Divide	N. Y. Curb			*23	Oct., 1923 0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	Mh.11, Ap.1, Q 0.05
Tonopah Mining	N. Y. Curb	4⅛	4⅛	4⅛	Se.30, Oc.21, 0.07½
Unity Gold	N. Y. Curb	*50	*50	*50	
West End Consol.	N. Y. Curb	*30	*30	*30	Mar., 1923 0 05
Yukon Gold	N. Y. Curb			*30	June, 1918 0.02

Stock	Exch.	High	Low	Last	Last Div.
SILVER					
Alvarado	Boston Cur'	†1	†*25		Oct. 1920 0.50
Beaver Consol.	Toronto	*27⅛	*26¼	*26⅞	May, 1920 0.03
Castle-Trethewey	Toronto	1.18	1.16	1.17	
Coniagas	Toronto	1.85	1.75	1.75	May, 1924 0.12½
Keeley	Toronto	1.61	1 54	1 60	Au.31,Se.15RX 0.12
Kerr Lake	N. Y. Curb	1⅜	1	1	Oc.1, Oc.15 Q 0.12½
La Rose	Toronto	*44¼	*40	*42½	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	*90	*90	*90	Jy. 2, Jy.15 0 05
McKiniey-Dar.-Sav.	Toronto	*18⅜	*15¼	*18⅛	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.76	2.75	2.75	Jy.1, Jy.15 0.12½
Nipissing	N. Y. Curb	4⅞	4⅝	4⅝	Se.30, Oc.20, Q 0.15
Ontario Silver	New York	9⅛	7⅛	9⅛	Jan., 1919 0.50
Temiskaming	Toronto	*17	*17	*17	Jan., 1920 0.40
SILVER-LEAD					
Ahumada	New York	10⅛	10⅛	10⅜	Se.19,Oc.2,OEx. 0.25
Bingham Mines	Boston	59	54	57⅛	Se.19, Se.30 Q 0.50
Cardiff M. & M.	Salt Lake			*60	De.16, No.18 0.10
Chief Consol.	Salt Lake	2.90	2.90	2.90	Ap 10, My. 1 0.10
Columbus Rexall	Salt Lake	*5	*4	*4	Aug., 1923 0.05
Erupcion	Boston Curb	2⅛	2⅛	2⅛	Se.19,Oc.2,Q Ex. 0.15
Federal M. & S.	New York	23⅛	21⅞	22	Fe.26, Mh.15 Q 1.75
Federal M. & S. pfd.	New York	63	61⅛	61⅞	Au.25, Se.15, 1.75
Hecla Mining	N. Y. Curb	16⅞	15⅞	16⅛	Au.15, Se.15 Q 0.50
Iron Blossom Con.	Salt Lake			*39	Oc.25, 1924 0.01½
Iron King Mining	Salt Lake	*57	*49	*57	
Keystone Mining	Salt Lake	*74	*70	*70	Au.12, Au.26 0.07½
LuckyJim	Spokane	13⅛	12⅞	13⅛	
Mammoth Mining	Salt Lake	2.95	2.80	2.95	My.15 My.25 0.10
Marsh Mines	Spokane	*7⅜	*7⅛	*7⅞	Se.15, Oc.1 0.15
Park Utah	Salt Lake	7.45	6.25	7.45	Se.15, Oc.1 0.15
Prince Consol.	Salt Lake	*30	*30	*30	
Silver King Coal	Salt Lake	9.40	9.30	9.40	Se.20, Oc 1, Q 0.25
Silversmith	Spokane	*25½	*24	*25	Oc.1, Oc.10 0.01
Tamarack-Custer	Spokane	*48	*40	*40	Sept, 1924 0.25
Tintic Standard	Salt Lake	13.75	13.75	13.75	Se.22, Se.29 0.40
Utah-Apex	Boston	7⅛	6⅞	6⅞	Oc.3, Oc.15, Q 0.35
Western Utah Copper	N. Y. Curb			*10	
IRON					
Bethlehem Steel	New York	41⅞	39½	41½	July, 1924 1.25
Colorado Fuel & Iron	New York	40⅛	37⅞	39⅜	May, 1921 0.75
Gt. North'n Iron Ore	New York	31⅛	30	31⅛	Ap.11, Ap.30 1.00
Inland Steel	New York	43¼	42	43	Au. 14 Sep. 1,Q 0.62½
Mesabi Iron	N. Y. Curb			2⅜	
Replogle Steel	New York	16	13⅛	15⅛	
Republic I. & S.	New York	51⅞	48⅛	51	May, 1921 1.50
Republic I. & S. pfd.	New York	92⅛	91⅛	92⅛	Se.15, Oc.1, Q 1.75
Sloss-Sheffield S. & I.	New York	103⅜	97⅛	102⅜	Se.10, Se.21 Q 1.50
Sloss-Shef. S.&I. pfd.	New York			98	Se.21, Oc.1, Q 1.75
U. S. Steel	New York	123⅜	118⅛	121⅞	Au.29,Au.31,Q Ex 1.75
U. S. Steel pfd.	New York	125	124⅛	125	Aug. 3, Aug. 29, Q 1.75
Virginia I. C. & C.	New York			37	Jan., 1924 1.50
Virginia I.C.&C.pfd.	New York			70	Jn.20, Jy.2, 2.50
VANADIUM					
Vanadium Corp.	New York	29⅞	28⅛	29	Aug.1, Aug.15 0.50
ASBESTOS					
Asbestos Corp.	Montreal	92	85½	91⅜	Se.3J, Oc.15 Q 1.50
Asbestos Corp., pfd.	Montreal	112⅜	96	111⅛	Se.30, Oc. 15, Q 1.50
SULPHUR					
Freeport Texas	New York	21⅛	15⅞	21⅛	Nov., 1919 1.00
Texas Gulf	New York	116⅛	108	114⅛	Au.31, Se.15, Q 2.00
DIAMONDS					
De Beers Consol.	New York			25⅛	Jy.27, Au.30 0.97
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	2⅛	2⅛	2⅛	
MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal	New York	51	49⅞	50⅛	Aug. 20, Sep. 1, Q 0.75
Amer. Metal pfd.	New York			116	Aug. 21, Sep. 1, Q 1.75
Amer. Sm. & Ref.	New York	113⅜	110⅛	112⅜	Jy.10, Au.1, Q 1.50
Amer.Sm.&Ref.pfd.	New York	113	112⅛	112⅛	Au.7, Se.1 Q 1.75
Consol. M. & S.	Montreal	132⅛	116	130⅞	Jn.30, Jy.15 0.75
Federated Metals	N. Y. Curb			27⅛	
Newmont Mining	N. Y. Curb	45	44⅛	44⅛	Oc.1, Oc.15 0.60
Southwest Metals	N. Y. Curb			1	
U. S. Sm. R. & M.	New York	48	45	46⅛	Oc.7, Oc.15 Q 0.75
U.S. Sm. R.&M.pfd.	New York	47⅞	46⅞	47⅛	Oc.7, Oc.15 Q 0.87½

* Cents per share. † Bid or asked. Q. Quarterly. SA. Semi-annually. M. Monthly. K. Irregular. I. Initial. X. Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange

LONDON QUOTATIONS, WEEK ENDED SEPT. 25, 1925

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	78/9	77/6	77/6	Aug. 1925	5(c)
British Platinum	8/10½	8/3½	8/6	Feb. 1925	2½
Bwana M'Kubwa	6/9	6/3	6/3		
Camp Bird	2/3½	2/3	2/3		
El Oro	5/1½	4/10½	5/—	Nov. 1924	2½*
Esperanza	—/9½	—/8	—/9½		
Frontino & Bolivia	11/3	10/4½	11/3	July 1925	3½
Mexican Corporation	13/10½	13/3	13/6		
Mexico Mines of El Oro	42/6	42/6	40/6	June 1925	10*
Nechi (pref. 10s.)				1921-22	25
Oroville Dredging	4/4½	4/—	4/—	Dec. 1923	3½
Ouro Preto	4/4½	4/4½	4 4½	May 1925	2½
St. John del Rey	14/—	13/6	14/—	June 1925	6½
San Francisco Mines	26/9	26/1½	26/3	June 1925	15
Santa Gertrudis	10/10½	10/6	10/6	July 1920	5
Selukwe (2s. 6d.)	9/10½	9/3	9/3	April 1917	6¼
S. American Copper	7/—	6/6	6/6	Nov. 1917	75
Tanganyika	46/9	42/6	45 —	Sept. 1925	5
Tomboy	4/1½	3/4½	3/6(Ex. div.)	Sept. 1925	5
Union Minière du Haut-Katanga (Brussels) 100 Fr	7.295	7.200	7.295	July 1925	150(b)

*Free of British income tax. (b) Belgian francs. (c) Swiss francs.